Superfund Program Cleanup Proposal

Butte Priority Soils Operable Unit

of the Silver Bow Creek/Butte Area Superfund Site

Butte, Montana

Introduction and Overview

The U.S. Environmental Protection Agency (EPA), in consultation with the Montana Department of Environmental Quality (DEQ), hereinafter referred to as "the State", is proposing a plan to address the cleanup of mining-related contamination from the Butte Priority Soils Operable Unit (OU) in Butte, Montana. The Butte Priority Soils OU includes the town of Walkerville, the part of Butte north of Silver Bow Creek and west of the Berkeley Pit, and a section of land that extends south from Silver Bow Creek to Timber Butte (see map, page 2).

EPA is the lead agency for the Butte Priority Soils OU, and the State is the supporting agency. Numerous other agencies, local governments, private technical consultants, academic research groups, a public technical assistance group, and other public interest groups participate in the project.

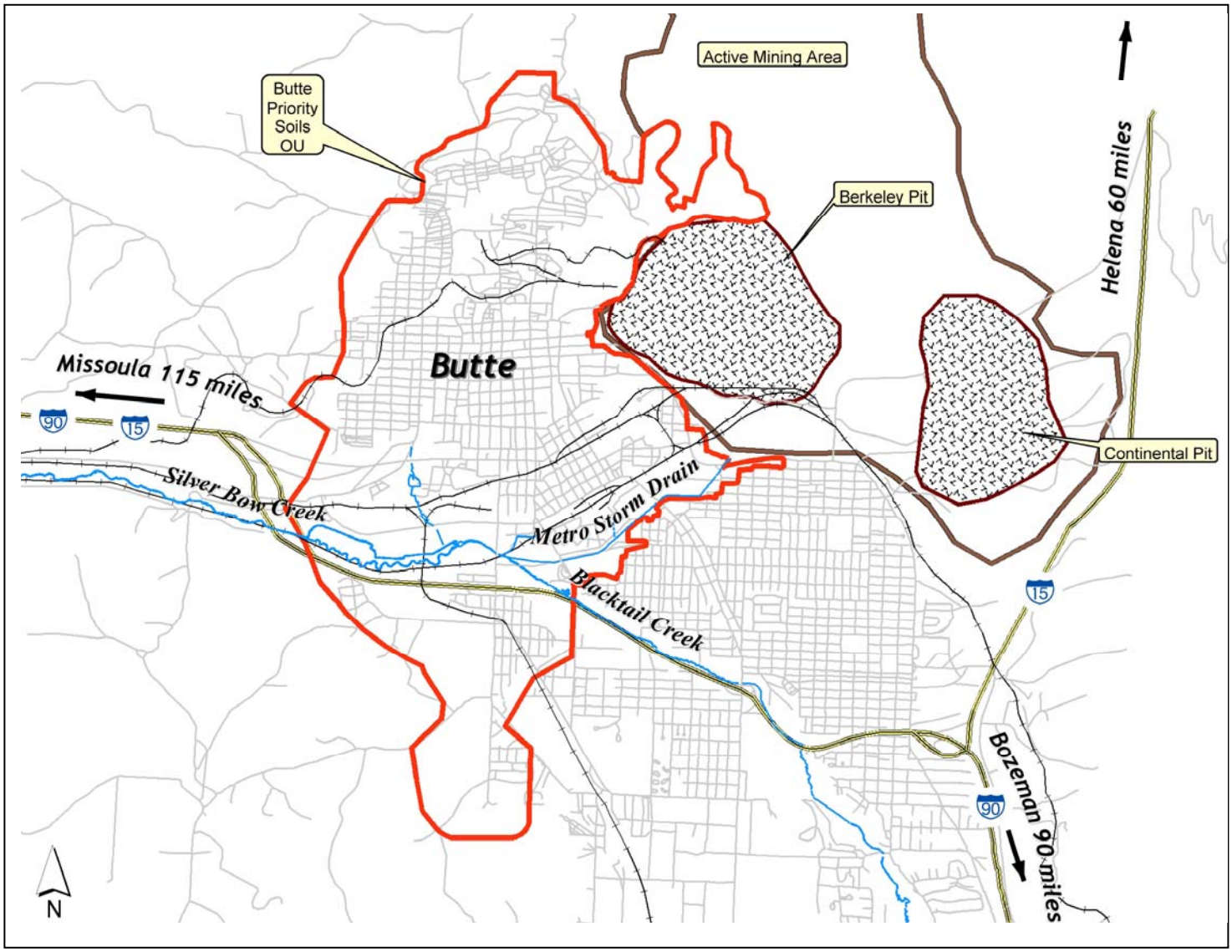
The participating potentially responsible parties (PRPs), hereafter referred to as the PRP Group; include the Atlantic Richfield Company (ARCO), Burlington Northern and Santa Fe Railway Company, Union Pacific Railroad Company, Montana Western Railway Company, and the Butte-Silver Bow City-County government. There are also many non-participating PRPs, mostly smaller parties. A list of all PRPs is available in the Administrative Record.

There will be a 60-day comment period from December 20, 2004 to February 18, 2005

Send written comments to EPA at:
ATTN: Ron Bertram
U.S. Environmental Protection Agency
Region 8, Montana Office
10 West 15th Street, Suite 3200
Helena, Montana 59626

And or comment in person on the record at:
BPSOU Public Meeting
January 25, 2005
6:30 pm to 8:30 pm
Carpenters Union Hall
156 W. Granite, Butte

Uptown Butte



Butte Priority Soils OU Site Map showing Berkeley and Continental Pits

The State concurs with part, but not all, of the Preferred Alternative. The State believes that the final remedy for Butte should include the removal of the former Parrott Tailings area and other accessible wastes in the Metro Storm Drain.

EPA believes that removal of these wastes would not restore the groundwater to its beneficial uses. Groundwater contamination will persist because there are secondary sources of contamination throughout the alluvial aquifer and because it is unlikely that all wastes could effectively be removed. Further, the aquifer has low volume and flow and would not likely be used for drinking water. EPA believes a conservatively designed capture and treatment system will be effective and protective of human health and the environment over the long term.

The Butte Priority Soils OU is one of seven remedial OUs in the Silver Bow Creek/Butte Area site. Other remedial OUs include:

- Butte Mine Flooding OU
- West Side Soils OU
- Active Mining Area OU
- Streamside Tailings OU
- Rocker Timber Framing and Treating Plant OU
- Warm Springs Ponds OUs

This Proposed Plan is provided in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended (CERCLA), also known as Superfund.[1] The plan is used to facilitate public involvement in the remedy selection process and is designed to:

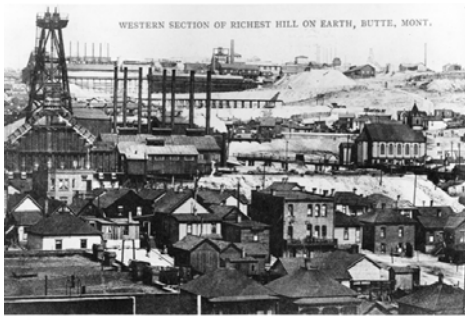
- Provide basic background information on the OU
- Present EPA's preliminary recommendation concerning how best to address contamination at the OU (the "Preferred Alternative")
- Present the alternatives that were evaluated and explain the reasons that EPA recommends the Preferred Alternative
- Solicit public review of and comment on all of the alternatives considered in the detailed analysis
- Provide information on how the public can be involved in remedy selection

This Proposed Plan highlights key information from the Remedial Investigation (RI) report and the Feasibility Study (FS) report prepared by the PRP Group. The RI and FS reports and many other documents in the Administrative Record are available to the public and can provide significantly more detail about the investigations conducted to date at the Butte Priority Soils OU.

Site Background

Mining activity started in Butte in 1864 with the discovery of gold. Over the next few decades, the Butte district evolved into the largest producer of copper in North America. Butte served as a globally-important mining, milling, and smelting district during WWII. Operating mines, mills, concentrators, and smelters were scattered across the Butte Hill which today represents the town of Walkerville and the urban "Uptown" portion of Butte.

[1] Specifically, CERCLA Section 117(a) and NCP Section 300.430(f).



Historic mining activity
Photo courtesy of Montana Historical Society, Helena

The mines produced waste piles, and the mills and smelters produced large quantities of tailings that were disposed of in ponds or dumped in Silver Bow Creek. Butte's smelters and mills also produced air emissions which distributed metal contaminants throughout the area. These contaminants include: arsenic, lead, mercury, aluminum, cadmium, copper, iron, silver, and zinc.

Investigations

EPA designated the original Silver Bow Creek Site as a Superfund site in September 1983, under the authority of the Comprehensive Environmental Response, Compensation, and Liability Act, as amended (CERCLA). Work began on a RI/FS in 1984.

During the course of the RI/FS, EPA recognized the importance of Butte as a source of metals contamination to Silver Bow Creek. Preliminary results from the Silver Bow Creek RI/FS indicated that upstream sources were partly responsible for the contamination observed in the creek. After a thorough analysis of the relationship between the two sites (Butte and Silver Bow Creek), EPA concluded that they should be treated as one site under CERCLA. The name was changed to the "Silver Bow Creek/Butte Area NPL Site" in 1987.

The scoping process for remedial actions for the Butte Priority Soils OU began in the mid-1980s. In 1989, EPA separated the Butte Priority Soils OU into Phase I and Phase II activities – to be implemented concurrently:

- **Phase I**. These activities focused on high-priority human health risks and resulted in the implementation of numerous Time Critical Removal Actions (TCRAs) and Non-Time Critical Removal Actions (N-TCRAs). These removal actions have included design and construction of storm water controls and physical removal and/or capping of the majority of potential arsenic and lead source areas within, or close to, residential neighborhoods (e.g., waste rock dumps, railroad beds, residential yards, and play areas).

- **Phase II**. These activities included conducting the RI/FS. The emphasis of Phase II was to evaluate impacts to the environment. This included an in-depth evaluation of arsenic and metal impacts on Silver Bow Creek and alluvial groundwater and both present and future human health impacts from source materials located outside of residential areas.

Key documents with detailed information about the BPSOU include:

- **Final Phase II Remedial Investigation Report** – BPSOU PRP Group 2002, approved by EPA

- **Technical Memorandum Regulatory Considerations for Storm Water Management at the Butte Priority Soils OU** – prepared by CDM for EPA, 2000

- **Butte Reclamation Evaluation System Butte Priority Soils OU** – prepared by CDM for EPA, 2003

- **Final Phase II Feasibility Study Report** – PRP Group 2004, approved by EPA
- **Final Focused Feasibility Study of the Metro Storm Drain** – prepared by CDM for EPA, 2004
- **Final Baseline Ecological Risk Assessment** – prepared by CDM for EPA, 2001
- **Preliminary Baseline Human Health Risk Assessment for Lowe Area One** – prepared by CDM for EPA, 1991
- **Baseline Human Health Risk Assessment for Lead** – prepared by CDM for EPA – 1994
- **Baseline Human Health Risk Assessment for Arsenic** – prepared by CDM for EPA, 1997
- **Technical Memorandum: Addendum to the Baseline Human Health Risk Assessment; Evaluation of Human Health Risks Associated with Exposure to Alluvial Ground Water** - prepared by CDM for EPA, 2000
- **Technical Memorandum: Addendum to the Baseline Human Health Risk Assessment; Response Action Operation and Maintenance** - prepared by CDM for EPA, 2000
- **Human Health Risk Assessment, Walkerville Residential Site** – prepared by URS for EPA, 2003

Previous Response Actions

EPA determined early in the investigation process that cleanup actions could not wait for the typical RI/FS process to be completed. A significant concern was the fact that people were living among the mine waste dumps and potentially being exposed to toxic levels of lead and arsenic. As a result, EPA implemented a series of response actions to address lead and arsenic source areas (see box on page 6 and map on page 7).

Over 400 acres of land within the OU have undergone extensive response actions. Most of this work was completed from the late-1980s through late-1990s. Two remaining TCRAs (railroad beds and storm water) will be completed in 2004 and final actions for two N-TCRAs (Lower Area One and residential soils/source areas) will be determined in the Record of Decision (ROD).

These past response actions were completed using the Superfund removal process. Although an accelerated process was used, Superfund law requires these actions be implemented in ways that contribute to the efficient performance of a final long-term remedial action, to the extent practicable.

Therefore, EPA required that the response actions be designed and constructed in a manner intended to be permanent. Implementation of these response actions has resulted in the reclamation, removal, or stabilization of almost all contaminant source areas and mine waste accumulations initially identified by the EPA as requiring a response action.

Often, but not always, this identification was due to the exceedence of arsenic or lead soil action levels at discrete locations within the OU. Storm water contributions and acute environmental risk also formed the basis of some of these actions.

Completed Response Actions

Time Critical Response Actions

- **Walkerville (1988).** Addressed mine waste dumps and residential soil areas contaminated with lead >2,000 mg/kg or mercury >10 mg/kg in Walkerville.
- **Timber Butte (1989).** Removed and consolidated ~40,000 cubic yards of contaminated soil.
- **Butte Priority Soils (1990 and 1991).** Mitigated risks from mine waste dumps, a concentrate spill, and seven residential yards in Butte and Walkerville.
- **Colorado Smelter (1992).** Removed and consolidated on-site 40,000 cubic yards of mine waste.
- **Anselmo Mine Yard and Late Acquisition/Silver Hill (1992).** Addressed a mine yard and several mine dumps in Butte.
- **Walkerville II (1994).** Addressed four additional dump areas with elevated soil lead levels.
- **Railroad Beds (ongoing).** Addresses railroad beds and adjacent residential yards that contain elevated concentrations of metals and arsenic.
- **Storm Water (ongoing -** begun in 1997). Addresses storm water problems in Butte. Includes reclamation of the Alice Dump and removal of ~50 cubic yards of mercury-contaminated soils in the Dexter Street area.

Non-Time Critical Response Actions

- **Lower Area One (ongoing).** Removal of accessible mine tailings impounded in the Silver Bow Creek floodplain from the historic Colorado Smelter and Butte Reduction Works facilities.
- **Butte Priority Soils OU (residential soils/source areas) (ongoing**). Addresses residential areas with soil-lead concentrations above the residential lead action level. Also reclaimed, or repaired to EPA standards, more than 50 sites that were above the lead action level for non-residential source areas.

Other Actions:

- **Lower Area One Manganese Removal (1992).** Removed manganese ore stockpiles in Lower Area One within the floodplain of Silver Bow Creek.
- **Old Butte Landfill/ Clark Mill Tailings (1998).** Completed RCRA corrective action at the landfill. Removed ~800,000 cubic yards of the Colorado Tailings from Lower Area One and placed them in the repository constructed at this site.
- **Walkerville (2000).** Tested all unsampled residential properties in Walkerville and conducted cleanups at specific residences.

In 1988, work started in Walkerville with the removal of lead-contaminated soil from yards and basements and cleanup of waste rock dumps. Numerous other cleanup actions were also implemented. The 2002 RI/FS report identifies 182 mining-related sites that have been impacted by, or are potential sources of, arsenic and metals. Nearly all of those source areas, with the exception of waste areas within the Metro Storm Drain, were addressed under removal authority. Significant source materials were removed, but most were capped in place.

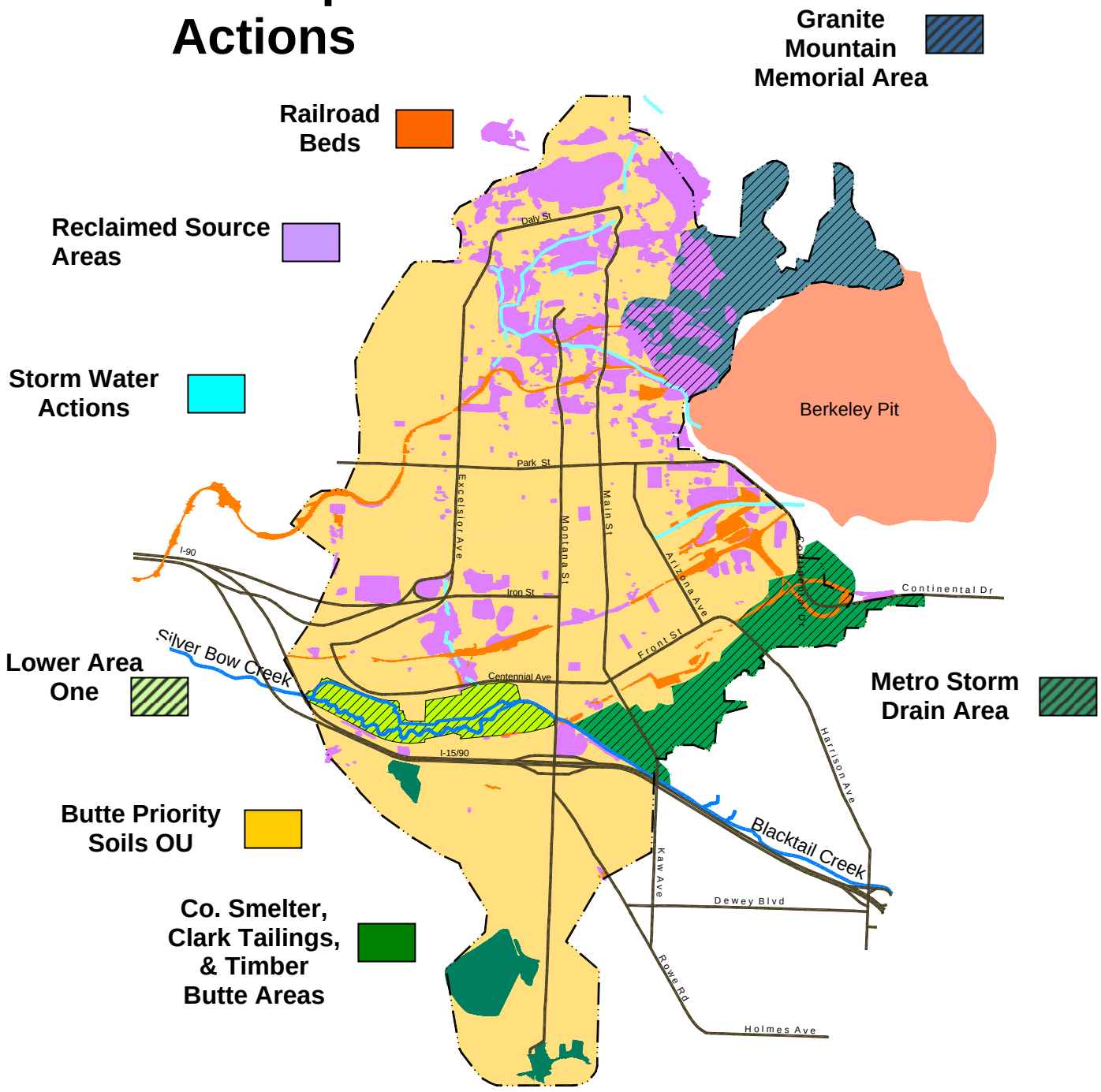
Another risk-reduction strategy has been the ongoing residential Lead Intervention Abatement Program operated by the Butte-Silver Bow County Health Department. This program has removed sources of lead contamination from about 200 yards and homes.

PRP Participation

Most of the work to date was performed by the PRP Group under unilateral or consent orders. The PRP Group was responsible for developing the Phase II RI/FS work plan, the RI/FS reports and most of the associated sampling and analysis plans, laboratory analytical protocols, site health and safety plans, data reports, and technical memoranda supporting the RI/FS. Other PRPs have been named by EPA, but have not participated in the PRP Group. EPA will request the participation of all viable PRPs in the implementation of the ROD.

EPA, in consultation with the State, conducted oversight of all early response and RI/FS activities, prepared human health and ecological risk assessments and the community involvement plan, and identified the Applicable or Relevant and Appropriate Requirements (ARARs). In consultation with the State, EPA will prepare the Proposed Plan and ROD.

Areas of Past and Future Response Actions



Adapted from graphic in Montana Standard and Butte-Silver Bow Planning/GIS coverage

Public Involvement

EPA has performed the following public involvement activities at the OU as required by CERCLA:

- Notified affected citizens
- Established the Administrative Record file and information repositories
- Conducted community interviews
- Prepared and revised the community involvement plan

EPA has also conducted a wide variety of other public involvement activities at in an effort to assist the public in providing meaningful input for ongoing site activities:

- Funded CTEC, a local community information and involvement group, with a Superfund Technical Assistance grant
- Prepared fact sheets
- Issued press releases
- Coordinated public and individual meetings
- Briefed local officials
- Issued public notices and advertisements
- Maintained and broadened the mailing list
- Updated EPA's webpage for the OU
- Wrote a monthly column for the *Montana Standard*
- Facilitated a citizen's work group

These site-specific support activities are described in greater detail in the Revised Community Involvement Plan.

Site Characteristics

Physical Characteristics

The Butte Priority Soils OU lies in the upper Silver Bow Creek valley, immediately west of the continental divide at an elevation ranging from approximately 5,400 to 6,400 feet. It is centered on the Butte Hill and urban Uptown Butte. The upper Silver Bow Creek valley is bounded on the east, south, and north by mountains with elevations reaching 10,000 feet. The valley is drained by two primary streams: Blacktail Creek and Silver Bow Creek. Surface water exits the valley toward the west. During wet weather conditions, storm water runoff from the Butte Hill drains toward the south and flows into Silver Bow Creek.

Groundwater movement in the valley mimics surface water movement and flows from higher elevation to lower elevation, exiting the valley beneath Silver Bow Creek just west of the OU. Alluvial groundwater and its interaction with mine wastes, contaminated soil, and surface water was the focus of the groundwater investigation. Deeper groundwater is addressed in the ROD for the Butte Mine Flooding OU.

Historic mining activity
Photo courtesy of Montana Historical Society, Helena

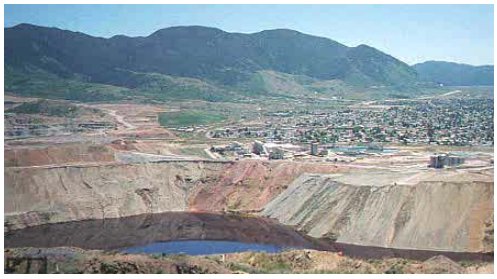
Butte Hill

The Butte Hill is the location of the historic Butte Mining District and the commercial and residential urban setting of Uptown Butte and the town of Walkerville. During the course of more than 100 years of mining in Butte, an estimated 500 underground mines, at least 8 smelters, and numerous mills and concentrators were operated on the Butte Hill producing millions of cubic yards of metaliferous mine waste (waste rock, mill tailings, slag, and aerial emissions). Arsenic and heavy metals contained in the waste rock dumps and contaminated soils on the Butte Hill pose a potential threat to human health and also have a demonstrated impact on water quality in Silver Bow Creek during storm water runoff events.

Headframe on the Butte Hill

Berkeley Pit

The Berkeley Pit is a large, open-pit copper mine that operated from 1955 through 1982. The total depth of the pit from the bottom to the highest rim is 1,780 feet. It encompasses approximately 675 acres (1.06 square miles) and has a volume of approximately 1.2×10^{10} cubic feet from the base elevation of 5,543 feet above sea level.



Berkeley Pit

When the mining stopped, dewatering was no longer necessary, and the deep-level pumps were shut down. This allowed groundwater to rise toward its natural, pre-mining levels. Contaminated water associated with the flooding of the Berkeley Pit is still rising and is hydraulically connected to underground mine workings and bedrock and alluvial aquifers. This was the focus of the Butte Mine Flooding OU and is not addressed in this Proposed Plan.

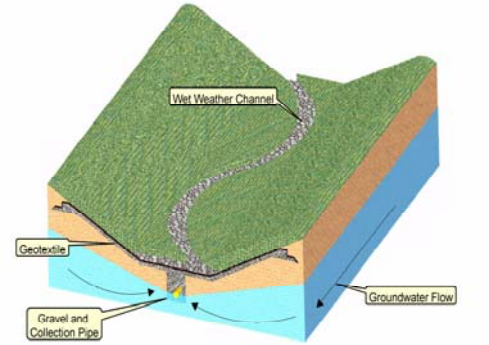
The Berkeley Pit does play a role in EPA's Preferred Remedial Alternative for the Butte Priority Soils OU. It has a demonstrated effect on groundwater flow within the alluvial aquifer that is critical with respect to the remedy for alluvial groundwater. Also, due to the immense size and location of the Pit, the proposed plan calls for diversion of some of the contaminated storm water to the Pit from the Butte Hill.

Metro Storm Drain

The Metro Storm Drain refers to a geographic area within the east-central portion of the OU that generally encompasses the historic Silver Bow Creek floodplain between Continental Drive and Blacktail Creek. The Metro Storm Drain structure is a man-made surface water conveyance constructed during the 1930s to provide a means of transporting mine water, sewage, and storm water out of Butte. It is the site of the former Silver Bow Creek headwaters.

It was used by the Anaconda Copper Mining Company to discharge waste and wastewater from the Berkeley Pit operation.

Metro Storm Drain was constructed by realigning and filling the original Silver Bow Creek channel. The upper portion of the drain is dry except during storm runoff or snowmelt episodes. The lower portion receives flow via groundwater discharge during normal flow conditions and contributes between 0.3 and 0.5 cubic feet per second to Silver Bow Creek. In 2004, ARCO completed construction of a subdrain beneath the Metro Storm Drain channel to capture shallow groundwater prior to its entering the alluvium beneath the Silver Bow Creek floodplain.



Subdrain beneath reconstructed Metro Storm Drain channel

Silver Bow and Blacktail Creeks

Silver Bow Creek originally extended from its mountain headwaters through what is now the mine area. With the advent of mining, Silver Bow Creek was rerouted, and the original channel and floodplain have been completely obliterated by the Berkeley Pit and the Yankee Doodle Tailings Pond.

Silver Bow Creek now begins at the confluence of the Metro Storm Drain and Blacktail Creek. The primary source of flow in Silver Bow Creek is inflow from Blacktail Creek, which normally contributes 11 to 15 cubic feet per second. The Metro Storm Drain and Silver Bow Creek floodplain receive wet weather flow from subbasins on the Butte Hill.

Lower Area One

Lower Area One encompasses the Silver Bow Creek floodplain in the area of the former Colorado Tailings and Butte Reduction Works, between Montana Street and the Interstate 90 overpass. This area has been host to at least four very large milling and smelting facilities, all of which contributed to the deposition of ore processing wastes and tailings to the area.

In late 1991, EPA initiated the Lower Area One removal action to address imminent threats to human health and the environment. This response action entailed the removal of accessible mine tailings and contaminated soils in the Silver Bow Creek floodplain. In 1997, the PRP completed excavation and removal of approximately 1.2 million cubic yards of tailings and contaminated soils from the floodplain. The area was then partially backfilled with clean material, and the stream channel and floodplain were reconstructed.

Silver Bow Creek floodplain after Lower Area One removal

Because of permanent structures at Lower Area One and limitations in removal depth, not all tailings and contaminated soils could be removed. Tailings remain beneath the limits of the

excavation and beneath the Metro Sewage Treatment Plant facility, historic slag walls, the railroad grade along the southern perimeter of Lower Area One, and other immovable structures. A groundwater collection system was constructed in 1998 to capture impacted groundwater, and the Lower Area One revegetation plan was completed, including stream bank reclamation.

Alluvial Aquifer/Groundwater

The alluvial aquifer in the upper Silver Bow Creek valley is about 3.5 miles wide and 7 miles long and occupies an area of approximately 23 square miles. South of Butte, the aquifer extends to the base of the Highland Mountains. North and east of Butte, the aquifer extends from the continental divide toward the south-southeast beneath the historic upper Silver Bow Creek channel. The lower portion of this alluvial drainage (south of Berkeley Pit) is now referred to as the Metro Storm Drain area. A significant portion of the groundwater flow that would normally be part of this aquifer is intercepted by mining excavations in and near the Berkeley Pit and the Continental Pit.

At the confluence of Blacktail Creek and the Metro Storm Drain, groundwater flow turns toward the west beneath Silver Bow Creek and exits the Silver Bow Creek valley just west of the Butte Priority Soils OU boundary and Lower Area One. Small quantities of groundwater enter the Silver Bow Creek floodplain system from subdrainages on the Butte Hill (e.g., Missoula Gulch, Buffalo Gulch).

Near the confluence of Blacktail Creek and the Metro Storm Drain, the alluvial aquifer thins to approximately 30 feet. It continues to thin in a westward direction as the valley narrows. Immediately west of Lower Area One, at the outlet of the Silver Bow Creek valley, the width of the alluvium narrows to about 900 feet. The alluvial deposits in this narrow region are less than 20 feet thick.

The reduction in lateral extent and thickness of the alluvium near the west end of the OU greatly decreases the cross-sectional flow area of the alluvial system, resulting in a "neck" through which only a very small flux of alluvial groundwater can exit the basin. This reduction causes much of the alluvial groundwater to discharge to the lower reaches of Blacktail Creek, the Metro Storm Drain, and Silver Bow Creek. Measured gains over these surface water reaches support the conclusion that nearly all alluvial groundwater from the Silver Bow Creek valley leaves the basin as surface water. Since the Lower Area One groundwater collection system began operation in 1998, the flux of alluvial groundwater that exits the upper Silver Bow Creek valley is less than 6 gallons per minute or approximately 10 acre-feet per year.

Within the OU, the alluvial aquifer encompasses the Metro Storm Drain area and the floodplain areas of lower Blacktail Creek, Grove Gulch Creek and a portion of Silver Bow Creek. The thickness of the alluvium is generally greater than 200 feet in the upper Metro Storm Drain area and decreases toward the south and west to less than 30 feet within and west of Lower Area One.

Alluvium pinches out towards the north, as the Butte Hill rises away from Silver Bow Creek and the Metro Storm Drain. South of Silver Bow Creek, the alluvial aquifer extends up a portion of Grove Gulch Creek in the southern portion of the OU.

A groundwater drainage divide in the alluvial aquifer is present south of the Berkeley Pit and is attributable to past mine dewatering operations in the pit area. Groundwater north of this divide

flows toward the pit. South of the divide, groundwater flows southward toward lower Metro Storm Drain, Blacktail Creek, and Silver Bow Creek. This groundwater divide will be maintained as a condition of the Butte Mine Flooding OU ROD. Alluvial groundwater quality south of the divide is severely contaminated with elevated metals levels, especially in the upper Metro Storm Drain and in Lower Area One.

Granite Mountain Memorial Area

The Granite Mountain Memorial area is a recent addition to the OU. It is dedicated to the 168 miners who perished in the disastrous Granite Mountain-Speculator fire in 1917. Unlike other portions of the OU, it comprises a relatively large area of unreclaimed waste dumps that are not located in residential areas.

Granite Mountain Memorial Area

In coordination with the Regional Historic Preservation Plan, EPA chose to include the Granite Mountain Area in the OU to ensure protection of visitors and to enhance local historical resources.

Railroad Beds

A railroad network to service, support, and supply the mining activity was essential to mining in Butte. Ore from Butte was transported via rail to smelters in Anaconda for nearly 100 years. As Butte's population grew, the rail lines transected many of the neighborhoods. Today, approximately 10 miles of railroad beds exist within the OU. Elevated concentrations of arsenic and heavy metals occur in these railroad beds due to the use of mining-related waste materials for subgrade soil or ballast and from spillage from rail cars during transport of ore and ore concentrates.

Butte-Anaconda Pacific Rail line in Butte, 1904
Photo courtesy of Montana Historical Society, Helena

Nature and Extent of Contamination

Mining in Butte left an urban landscape littered with unvegetated or sparsely vegetated mine wastes, often containing elevated concentrations of contaminants.

The key contaminants of concern vary according to media and include:

- **Solid Media**. Arsenic, lead, and mercury
- **Surface Water**. Aluminum, arsenic, cadmium, copper, lead, iron, mercury, silver, zinc
- **Groundwater**. Arsenic, cadmium, copper, lead, mercury, zinc

Non-Residential Solid Media

Numerous investigations have been conducted to examine the chemical characteristics of soil and mine waste in residential, commercial, and industrial areas of the OU. Nearly 3,000 soil/waste samples were collected and analyzed, and the results were used to identify areas with elevated metal content and to implement response actions reclamation activities.

More than 1,000 surface soil samples have been collected in non-residential areas of the OU. Twenty percent of these

exceeded risk-based action levels for arsenic or lead. EPA has addressed most solid media in non-residential areas that exceeded the arsenic and lead action levels through past response actions. Other known source areas exceeding action levels or contributing to storm water problems will be actively addressed under the Butte Priority Soils ROD.

The initial quantity of contaminated soil and mine waste within the Butte Priority Soils OU is estimated to have been 12.4 million cubic yards. Approximately 8.4 million cubic yards of mine waste have been removed or reclaimed as a result of completed response actions. This leaves roughly 4 million cubic yards of wastes that are being considered for future remedial action at the site.

Metro Storm Drain

Wastes present in the Metro Storm Drain area are largely buried below the surface. An estimated 2.5 million cubic yards of mining-related waste and intermixed fill material are present within the area. Roughly 45,000 cubic yards were removed in 2004 while reconstructing the Metro Storm Drain channel and installing the groundwater collection system (subdrain). In some places, tailings or fill material extend to depths of over 25 feet below grade. Some of these wastes are in direct contact with groundwater and serve as a primary source of contaminants to alluvial groundwater.

Lower Area One

Prior to implementation of the Lower Area One response an estimated 2.2 million cubic yards of tailings and contaminated soils were present within the Silver Bow Creek floodplain at Lower Area One. The PRPs removed approximately 1.2 million cubic yards in 1998. Mining wastes remain beneath the Metro Sewage Treatment Plant, under the railroad grade along the southern border of Lower Area One, and beneath the historic slag walls.

Blacktail and Silver Bow Creeks

Blacktail Creek at the confluence of Metro Storm Drain marks the beginning of Silver Bow Creek. From a short distance above this confluence to the slag canyon downstream, stream banks and the nearby floodplain of Blacktail and Silver Bow Creeks consists of waste materials. Additionally, as described in the Baseline Ecological Risk Assessment, the creek streambeds through this reach contain contaminated sediments. Also, visual observations show evidence of overland runoff from floodplain wastes to Blacktail and Silver Bow Creeks.

Granite Mountain Memorial Area

Surface soils and mine wastes in this area have been sampled and analyzed during three separate sampling programs. Of the 65 samples collected, only one exceeded the open space/ recreation action level for arsenic. Seven exceeded the source area action level for lead. Air monitoring is being conducted to ensure that future visitors will not be exposed to hazardous levels of airborne contaminants.

Railroad Beds

In late 1999, sampling was conducted to refine the TCRA area. Of the 300 surficial railroad bed samples collected, about 75 percent exceeded the arsenic action level. The volume of rail bed material that may exceed the arsenic action level was estimated to be 300,000 cubic yards.

Residential Soil, Indoor Dust, and Attic Dust

Many residences in Butte were built in close proximity to former mines and mineral processing facilities. In some

instances, homes were built directly on top of mine wastes. Thus, many early investigations included the collection of residential soil samples.

Residential properties near mining activities

In 2001, EPA completed an additional evaluation of the potential human health risks to children and adults living in Walkerville related to exposure to arsenic, lead, and mercury in outdoor soil, indoor dust, and attic dust.

Concentrations were generally highest in attic dust or basement soil, lower in outdoor soil, and lowest in living area dust. Approximately 20 percent of residential yard samples exceeded the lead action level. EPA has determined that there is not a complete exposure pathway, except in unusual circumstances for attic dust because attics are not living space and are infrequently accessed by residents.

Surface Water

The primary source of flow in Silver Bow Creek is inflow from Blacktail Creek. The Metro Storm Drain and Silver Bow Creek floodplain also receive storm runoff and snow melt flow from subbasins on the Butte Hill. The Lower Missoula Gulch subbasin intercepts shallow groundwater and has a base flow of 0.1 to 0.3 cubic feet per second.

Perennial stream flow also occurs in Grove Gulch south of Silver Bow Creek. Grove Gulch Creek discharges flow to Blacktail Creek upstream of its confluence with Metro Storm Drain. Normal base flow near the mouth of Grove Gulch is less than 0.2 cubic feet per second.

In addition to the perennial flow and storm water runoff, Silver Bow Creek receives discharge from the Metro Sewage Treatment Plant. This discharge is normally about 30 percent of the total base flow in Silver Bow Creek. Data from the 1980s and early 1990s demonstrated elevated metals concentrations in Silver Bow Creek during base flow and storm flow conditions. Water quality was poor and often failed to achieve state standards.

Prior to the previous response actions, the major contributors of metals to Silver Bow Creek during base flow periods were:

- Surficial tailings in Lower Area One (through which Silver Bow Creek flowed prior to 1997). These were largely removed during the Lower Area One cleanup.
- Groundwater contaminated by the Colorado tailings (at Lower Area One) expressed directly as surface water to Silver Bow Creek

The current contributors of metals are:

- Metals laden sediment, stream bank, and adjacent floodplain deposits distributed along Silver Bow Creek
- Groundwater contaminated by sources within the Metro Storm Drain expressed as surface water in Metro Storm Drain
- Contaminated groundwater in the Missoula Gulch drainage expressed

as surface flow just north of Lower Area One

The major contribution of metals to Silver Bow Creek during periods of storm water flow is run-off from the Butte Hill, which transports metals-laden sediments from the waste sources to the Metro Storm Drain and Silver Bow Creek. Metal-laden evaporative salts also dissolve into solution and eventually discharge to Silver Bow Creek.

The pre-1998 base flow water quality in Blacktail Creek was considered relatively good, and the mean values for all contaminants of concern in this stream were below their respective Montana water quality standards. However, Blacktail Creek periodically exceeds current State aquatic life standards. In comparison, water quality in Silver Bow Creek was very poor during this time. Mean values for all contaminants of concern were above their respective standards; at times by orders of magnitude.

Because of the poor water quality in Silver Bow Creek, response actions were undertaken in the mid-1990s. In 1997, 1.2 million cubic yards of tailings and contaminated soils were removed from Lower Area One and that portion of Silver Bow Creek was reconstructed. Also, an interception trench and a system of treatment lagoons were constructed at Lower Area One to capture and treat contaminated groundwater (which formerly discharged directly to Silver Bow Creek).

Actions taken to date have improved base flow water quality in Silver Bow Creek; however, significant exceedences of water quality standards still occur under wet weather flow.

Groundwater

Within the OU, the alluvial aquifer underlies the Metro Storm Drain area and the floodplain areas of lower Blacktail Creek, Grove Gulch Creek and a portion of Silver Bow Creek. The thickness of the alluvium is generally greater than 200 feet in the upper Metro Storm Drain area and decreases toward the south and west to less than 30 feet within and west of Lower Area One. The alluvial aquifer has been characterized, using over 200 wells and soil borings and geophysics. A large monitoring well network has provided hydrogeologic data that includes long-term water level measurements and information on aquifer characteristics.

Groundwater flow from the Blacktail Creek floodplain, Metro Storm Drain, and the Silver Bow Creek floodplain converges in the area of Lower Area One. Small quantities of groundwater enter the floodplain system from subdrainages on the Butte Hill (e.g., Missoula Gulch, Buffalo Gulch).

Lower Area One

Initial characterization of groundwater quality in Lower Area One in the late-1980s and early-1990s indicated that alluvial groundwater was severely degraded and had a significant impact on surface water quality in Silver Bow Creek. The Colorado Tailings and other waste materials in Lower Area One were partially saturated with groundwater and this resulted in significant contaminant loading to Silver Bow Creek.

As previously described, the Lower Area One cleanup entailed excavating and removing significant quantities of tailings and contaminated soils, backfilling with clean fill, restoring the Silver Bow Creek channel, and constructing a hydraulic control channel. Groundwater remains contaminated due to leaching of metals from inaccessible tailings and other

wastes in the area. However, current hydraulic controls prevent contaminant loading to Silver Bow Creek by allowing for the capture and treatment of groundwater.

Metro Storm Drain

The alluvial aquifer is thicker than 250 feet beneath the upper Metro Storm Drain and thins to approximately 25 feet near the confluence of Metro Storm Drain and Blacktail Creek.

Buried tailings in the upper Metro Storm Drain area are mostly the remnants of tailing impoundments constructed for wastes from the Parrott Smelter. The most notable waste deposits in the lower Metro Storm Drain are the North Side and the Diggings East Tailings.

The alluvial aquifer receives recharge primarily from precipitation, snowmelt, and runoff from the Butte Hill. The cone of depression created by the Berkeley Pit intercepts all groundwater flow in the alluvial and bedrock aquifers north of the Metro Storm Drain area. Most groundwater in the upper and middle Metro Storm Drain is expressed as surface water in the lower reaches of the Metro Storm Drain channel.

Groundwater in the Metro Storm Drain area is severely impacted by buried and fluvially deposited mining wastes throughout the Silver Bow Creek floodplain. Impacts are greatest beneath and downgradient of the Parrott Tailings, North Side Tailings, and Diggings East Tailings. Contaminants in these areas exceed applicable water quality standards, in some cases by several orders of magnitude. Impacts to groundwater quality are apparent in the lower Metro Storm Drain area, but they are generally not as widespread or concentrated as in the middle and upper reaches of the Metro Storm Drain.

Groundwater quality is impacted to a depth of at least 150 feet beneath the Parrott Tailings and to at least 70 feet beneath the Diggings East Tailings. Impacts to alluvial groundwater in lower Metro Storm Drain are relatively shallow.

Contaminant migration in the alluvial aquifer is slow in the Metro Storm Drain. Contaminants observed in shallow groundwater discharging to the channel in lower Metro Storm Drain result primarily from leachate from the North Side and Diggings East Tailings. Deeper contamination from the Parrott is expected to take at least 200 years to reach lower Metro Storm Drain according to EPA Region 8 estimates.

In early 2004, Montana Bureau of Mines and Geology, with funding provided by EPA and the Montana Natural Resource Damage Program, installed monitoring wells at four sites along the groundwater flow path between the Parrott Tailings area and the confluence of Blacktail and Silver Bow Creeks. The wells were drilled deeper than most others in the area; the objective was to fill important data gaps about the aquifer lithology and groundwater quality in the intermediate portions of the alluvial aquifer.

In 2003, as directed by the Consent Decree for the Butte Mine Flooding OU, excavation along the Metro Storm Drain channel was conducted to install a pipeline to convey effluent from the Horseshoe Bend/Berkeley Pit Treatment Plant. The PRP over-excavated the Metro Storm Drain area and installed a subsurface groundwater collection system (subdrain) along the path of the old Metro Storm Drain channel. The channel was reconstructed over the subdrain to convey wet weather flows.

This subdrain captures most groundwater that formerly discharged to the Metro Storm Drain channel (base flow) and conveys it to a pump vault. At

this time, the captured groundwater is diverted from the pump vault to Silver Bow Creek untreated. Beginning in 2005, this water will be treated at Lower Area One.

Air

Air quality data collected over the past decade indicate that late fall, winter, and early spring are generally associated with the highest particulate levels in Butte. These typically occur during temperature inversions and are primarily associated with smoke from wood burning, road dust, vehicle exhaust and, to a lesser extent, dust emissions from active mining and milling operations. Unreclaimed source areas were not a significant source of particulate matter emissions, even prior to any of the reclamation actions.

Principal Threat Wastes

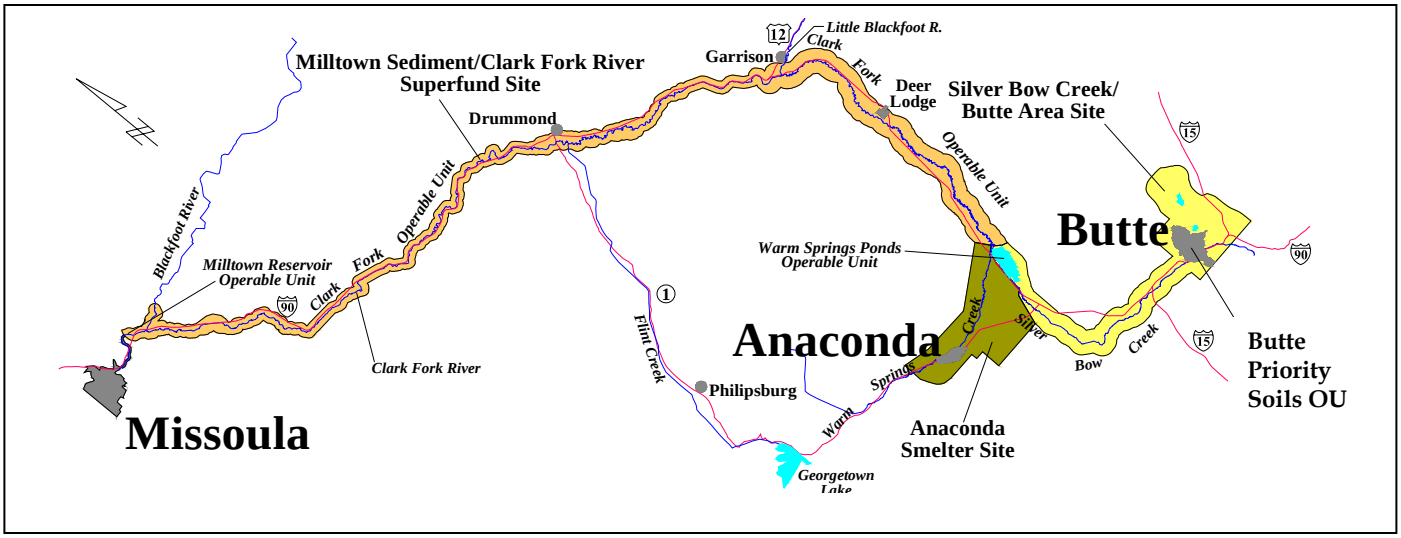
EPA does not believe any of the remaining wastes within the OU constitute highly toxic and mobile source wastes – known in Superfund as "principal threat wastes".

Scope and Role of Operable Unit

The Butte Priority Soils OU is part of the Silver Bow Creek/Butte Area Site, which is part of the Clark Fork Basin Superfund complex. The complex includes four Superfund sites in the Basin listed on the National Priority List (NPL):

- **Silver Bow Creek/Butte Area Site** – listed in 1983 and 1987
- **Montana Pole Site -** listed in 1987
- **Anaconda Smelter Site** – listed in 1983
- **Milltown Reservoir Sediments Site** – listed in 1983

These sites extend 140 miles, from the headwaters of Silver Bow Creek north of Butte to the Milltown Reservoir near Missoula, Montana.



Clark Fork Area Superfund Sites

The Silver Bow Creek/ Butte Area Site encompasses approximately 85 square miles, including the entire length of Silver Bow Creek and associated land contamination, from Butte westward (26 miles) to the Warm Springs Ponds near Anaconda. The Silver Bow Creek/Butte Area NPL Site is divided into two portions for administrative purposes - the Butte portion and the original portion.

Butte Portion of the Silver Bow Creek/Butte Area Site

The Butte Priority Soils OU is one of four remedial OUs within Butte portion:

- **Butte Priority Soils OU.** This area consists of historic mining areas within Butte and the adjacent town of Walkerville. The RI/FS focused on contaminants in soil and mine waste, surface water, and alluvial groundwater in the urban area encompassing the historic Butte Mining District.

- **Butte Mine Flooding OU.** This area consists of flooding of the Berkeley Pit and hydraulically connected underground mine workings and associated bedrock and alluvial aquifers in response to the cessation of dewatering practices. It also addresses the bedrock groundwater system under a large portion of the Butte Priority Soils OU.

  EPA has completed a RI/FS for this OU, and a ROD was released in 1994. A state-of-the-art treatment plant was recently completed to treat inflow from the active mine area before discharging this water into Silver Bow Creek. Berkeley Pit water will be treated when rising water levels in the pit reach a critical level. Treated water will be discharged to Silver Bow Creek or reused within the active mine.

Butte Mine Flooding OU

- **West Side Soils OU**. This OU encompasses areas of Silver Bow County that have experienced mining activity but lie outside of other OUs. This is generally north and west of Butte Hill. EPA is currently conducting RI/FS planning for this OU, but the site has not been funded over the past several years.

- **Active Mining and Milling OU.** This area is located west and northwest of the Butte Priority Soils OU and consists of the permitted mine area currently operated by Montana Resources. In 2002, EPA deferred Superfund action at the site to state authority under the mine operating permit.

Active Mining and Milling OU

The Preferred Alternative discussed herein is intended to be the final remedial action for the Butte Priority Soils OU only. Final remedial actions for the remainder of the Butte portion of the Silver Bow Creek/ Butte Area site are addressed in the remaining four OUs discussed above.

Original Portion of the Silver Bow Creek/Butte Area Site

The original portion of the Silver Bow Creek/Butte Area NPL site includes three OUs:

- **Streamside Tailings OU**. This area covers contamination along and within the Silver Bow Creek floodplain, downstream of the historic Butte Mining District and between the western end of the Butte Priority Soils OU (Lower Area One) and the point at which Silver Bow Creek enters the Warm Springs Ponds. The OU extends for approximately 26 creek miles between Butte and Warm Springs.

Streamside Tailings OU

- **Warm Springs Ponds OUs**. These OUs are located at the western border of the Silver Bow Creek/Butte Area site and consists of three man-made ponds covering 2,400 acres at the confluence of Silver Bow, Mill, Willow, and Warm Springs creeks. The ponds were constructed by the Anaconda Copper Mining Company between 1918 and 1959 to control the amount of mine and mill tailings and contaminated sediment carried into the Clark Fork River from Silver Bow Creek.

  All mining-related contamination in these ponds is the result of migration from upstream sources (e.g., from Butte). RODs for these OUs were signed in 1990 and in 1992.

Warm Springs Ponds

Remedial action has included removal of tailings, modification of channels to route flood flow, modification of berms, establishment of monitoring systems, upgrading of treatment systems, construction of wet-closure berms, chemical fixation of contaminated tailings and soils, long-term monitoring, and institutional controls. Cleanup (including tailings removal, physical modifications to ponds, monitoring, and institutional controls) was completed in 1995. EPA's latest five-year review of the remedy found that it continues to protect human health and the environment.

- **Rocker Timber Framing and Treating Plant OU.** This OU is located 3 miles west of Butte and was the location of a wood treatment plant that operated for 48 years, closing in 1957. The plant produced treated wood for use in the underground mines in the Butte area. Spilled process materials (arsenic trioxide powder), treated wood chip residues, and leaked process solutions (creosote and caustic heated arsenic brines) resulted in contamination of soils and groundwater.

  The cleanup included an innovative treatment technology to immobilize arsenic in soils and precipitate arsenic from groundwater. This remedy was implemented in 1997.

EPA's most recent five-year review of the remedy found that it continues to protect human health and the environment.

Summary of Site Risks

Human health and ecological risks posed by contamination determine whether or not a remedial action is warranted. Site risk assessments quantified current and potential human health and environmental risks from chemical contaminants in tailings, waste rock, soils, indoor dust, surface water and groundwater. There are no principal threat wastes at the OU.

The results of these assessments provide risk managers and the public with information about health risks. They help determine the need for cleanup, and provide a basis for determining the acceptable levels of contaminants that can remain onsite.

These results indicate that specific sources of site contamination are an unacceptable risk to human and ecological receptors. It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan is necessary to protect public health or welfare or the environment from actual or threatened releases of contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

Contaminants of Concern

Although previous response actions have eliminated some exposure pathways in many areas, mining-related contaminants are still present at concentrations that exceed acceptable risk levels.

Exposure Pathways

At the Butte Priority Soils OU, the primary sources of contaminants are mining- and ore-processing wastes, which include waste rock dumps, milling and concentrator wastes, and smelting wastes. The primary ways that these contaminants move are wind erosion, infiltration, percolation, and runoff.

Movement of contaminants can also occur from secondary sources. These include surface soils to surface water by runoff, transport to groundwater through leaching, infiltration and percolation, and contaminated dust to other media through wind erosion.

The means by which human or ecological receptors are exposed to contaminants is called the "exposure pathway." Most sites have several exposure pathways, such as ingestion of dust, contact with skin, ingestion of water, etc. Depending upon the characteristics of the contamination and the population, some pathways will be more important than others. The most important pathways are referred to as the "primary" exposure pathways, and those of lesser importance are referred to as "secondary" exposure pathways.

All primary and secondary transport pathways at the OU were individually evaluated by EPA. Those that were complete and presented a significant risk to human health or ecological receptors (plants and animals) were evaluated quantitatively in the risk assessments.

Remedial alternatives were designed to eliminate exposure pathways through excavation, capping, land reclamation, institutional controls, storm water controls, and groundwater control and treatment.

Human

For humans, the primary exposure pathways at the OU are:

- Ingestion of surface soils (for residents, commercial workers, and railroad workers)
- Ingestion of interior dust (for residents and commercial workers)
- Dermal exposure to surface water (for recreational visitors)
- Ingestion of surface water (for recreational visitors)
- Ingestion of alluvial groundwater risks were calculated although no current exposures occur

Only one significant secondary exposure pathway was identified: inhalation of fugitive dust (for residents, commercial workers, railroad workers, and recreational visitors).

Ecological

Because the site is in an urban setting, risks to ecological receptors are limited, and EPA focused on ecological risks to the aquatic habitat of Silver Bow Creek and surface water ponds that might be habitats for waterfowl.

Animals in this aquatic habitat may be exposed to toxic levels of contamination in various ways:

- **Fish and benthic macroinvertebrates.** These animals may be exposed by breathing or touching surface water and sediment and by ingestion of prey or sediment.
- **Waterfowl**. Waterfowl may be exposed by direct ingestion of surface water and sediments or by ingestion of contaminated prey.

The State and the U.S. Fish and Wildlife Service maintain a strong interest in adequate protection of aquatic receptors which are currently at risk.

Summary of Human Health Risk

EPA conducted several assessments of potential human health risks within the Butte Priority Soils OU. These include:

- Preliminary Baseline Human Health Risk Assessment for Lower Area One.
- Baseline Human Health Risk Assessment for Lead.
- Baseline Human Health Risk Assessment for Arsenic (CDM 1997b) and Enforcement/Action Memorandum - Railroad Bed Time Critical Removal Action Attachment A: Arsenic Action Levels.
- Technical Memorandum: Addendum to the Baseline Human Health Risk Assessment; Evaluation of Human Health Risks Associated with Exposure to Alluvial Ground Water - Butte Priority Soils Operable Unit.
- Human Health Risk Assessment, Walkerville Residential Site.

Major findings of these assessments are highlighted below.

Human Health Risk

EPA evaluated risks from all known sources of lead (mining, paint, water supply pipe solder, and others). Lead is associated with significant non-cancer risks. At the OU, risks from lead in mine waste were unacceptable. Mean soil lead levels in nearly 26 percent of residential yards could result in blood lead levels greater than 10 micrograms per deciliter (µg/dL).

EPA also evaluated potential risks from arsenic in soils, interior house dust, and surface water. Results indicted that carcinogenic risks to residents were unacceptable.

A risk assessment of the alluvial groundwater throughout the OU showed that cancer risks are driven by arsenic concentrations and are unacceptable in major portions of Butte (Buffalo Gulch, West Side, Railroad Yards, Lower Area One, and the Metro Storm Drain exposure units).

Non-cancer risks (systemic risks) from ingestion of alluvial groundwater are location- and element-specific. Blood lead levels in children would be unacceptable in Lower Area One and Metro Storm Drain from groundwater ingestion.

Development of preliminary remediation goals (PRGs) for lead and arsenic at the OU are described in detail in the Final Preliminary Remediation Goal Technical Memorandum for the Walkerville Residential Site. PRGs were calculated for lead, arsenic and mercury in outdoor soil and mercury vapor in indoor air for residential receptors. PRGs were derived primarily using exposure scenarios and assumptions from EPA's 2003 Human Health Risk Assessment for the Walkerville Residential Site.

The PRG for lead was developed using EPA's Integrated Exposure Uptake Biokinetic (IEUBK) Model for Children in 1994 during EPA's Baseline Human Health Risk Assessment for Lead. Site-specific inputs were used for lead concentrations in soil, house dust, and soil lead bioavailability. The soil lead bioavailability of 12% used in the risk assessment for lead was based on geochemical speciation and bioavailabiltiy studies in rats and swine. The soil lead bioavailability of 10% used in the Walkerville risk assessment was based on a more current swine bioavailability study.

PRGs of 1,200 and 1,575 mg/kg were calculated by the IEUBK model for the 1994 Human Health Risk Assessment for Lead and the 2003 Human Health Risk Assessment for the Walkerville Residential Site, respectively. These PRGs represent the average yard soil concentration which would result in a no more than 5% probability of an individual child exceeding a blood lead level of 10 ug/dL.

The PRGs for arsenic were developed according to EPA's Risk Assessment Guidance for Superfund. Site-specific inputs were used for arsenic in soil and house dust, and the bioavailability of arsenic in soil. Bioavailabilities of 18 and 25% were used for soil and indoor dust, respectively, based on bioavailability studies in both monkeys and swine. The remainder of the equation inputs were default values recommended by the EPA guidance to define the reasonably maximum exposed individual. PRGs were presented representing cancer risks of 1 in 10,000, 1 in 100,000 and 1 in 1,000,000. The selected PRG of 250 mg/kg represents a 1 in 10,000 cancer risk.

Proximity of mining to residential areas

Lower Area One

Based on current and future land-use, occupational, recreational (swimming, inner-tubing), trespassing, and residential exposure scenarios were evaluated for surface and groundwater. Daily ingestion of groundwater presents a substantial risk.

Based on a future residential scenario, unacceptable carcinogenic risk was determined for exposure to arsenic in groundwater. Unacceptable non-carcinogenic risk was predicted for exposure to arsenic, cadmium, and zinc in groundwater. Lead in groundwater presented a potential non-cancer concern because daily ingestion of this water may result in blood lead levels greater than 10 µg/dL.

Exposure to contaminants in surface water and in groundwater for non-residential exposure scenarios, such as swimming, *did not* pose a human health risk.

Walkerville Outdoor Soil and Indoor Dust

Results indicated that outdoor soil in residential yards, soil in earthen basements, and dust in living areas and attics are sources of arsenic, lead, and mercury. In general, concentrations of these metals were highest in attic dust or basement soil, lower in outdoor soil, and lowest in indoor living area dust.

Lead in outdoor soil and indoor dust at Walkerville residences presents unacceptable health risks to young children. Non-cancer risks for arsenic and (generally) mercury in outdoor soil and indoor dust are at acceptable levels.

EPA worked with the Agency for Toxic Substances Disease Registry to conduct a use survey for attics in Walkerville. The survey found that very few residents actually use attics for living space and, therefore contact with contaminants in attic dust would not occur over a duration of time that would present unacceptable exposures. Thus, contaminants in attic dust do not pose unacceptable risk because there is not a complete exposure pathway. However, if attics are accessed through remodeling or ceiling and wall deterioration, or other pathways are established, an unacceptable risk may occur.

Cancer risks from exposure to arsenic in outdoor soil and indoor dust were within EPA's acceptable range.

EPA also conducted a quantitative risk assessment of risks associated with wastes left in place should appropriate operation and maintenance of capped areas not be done appropriately. The assessment indicated that appropriate operation and maintenance of EPA response actions (including vegetated caps over mine waste) is required to maintain the integrity of the remedy in perpetuity. Failure to maintain the remedy will eventually lead to the uncovering and mobilization of contaminated material and re-exposing human and ecological receptors to adverse conditions.

Summary of Ecological Risk Characterization

Two ecological risk assessments have been conducted at the OU:

- Preliminary Baseline Risk Assessment for Lower Area One Silver – Butte Priority Soils OU
- Baseline Ecological Risk Assessment - Butte Priority Soils OU

EPA decided not to assess terrestrial risk at the OU because of the lack of terrestrial habitat in the urban setting of Butte.

Because the response actions altered the environmental conditions in Silver Bow Creek, ecological risks characterized in the 1991 preliminary assessment were no longer representative of site conditions. As a result, EPA and the Ecological Technical Assistance Group determined that, as

part of the RI/FS process, a post removal assessment of ecological risks was needed to determine if, and to what extent, ecological risks to aquatic receptors continue in Silver Bow Creek.

Waterfowl at the OU

The Baseline Ecological Risk Assessment, completed in 2001, focused on evaluating ecological risks to receptors in Silver Bow Creek from its origin at the confluence of Metro Storm Drain and Blacktail Creek to the Butte Metro Sewer discharge at the downstream (western) extent of the Butte Priority Soils OU. It also evaluated risks to waterfowl in on-site ponds due to residual impacts from mine waste and other mining-related sources within the OU after implementation of source removal activities at the site.

Major findings of the Baseline Ecological Risk Assessment are highlighted below. In general the assessment found that response actions taken at Lower Area One to remove wastes from the Silver Bow Creek floodplain and to minimize the impacts from contaminated groundwater have reduced the risks to ecological receptors in the reconstructed reach of the creek.

- Unacceptable risks to aquatic receptors were found under current conditions – primarily in Silver Bow Creek (e.g., Missoula Gulch and Metro Storm Drain).
- The primary contributors to current ecological risk are: surface water (cadmium, copper, and zinc); stream sediment (arsenic, cadmium, copper, lead, and zinc); and on-site ponds (copper and zinc)
- Dissolved cadmium, copper, and zinc in surface waters are the most important chemical stressors for aquatic life.
- Arsenic, cadmium, copper, lead, and zinc in sediments are the major chemical stressors for benthic macroinvertebrates. These metals may also contribute to cumulative toxicity in fish and other aquatic biota. Contaminated sediments also impair physical habitat, especially in depositional areas.
- Waterfowl may be at risk from consumption of water, sediment, aquatic vegetation, and aquatic invertebrates contaminated with arsenic, cadmium, copper, lead, or zinc.
- Greatly reduced concentrations of certain metals in surface water and sediment are needed to protect sensitive organisms inhabiting or using these media.
- Certain locations are consistently associated with the highest risk. These include locations in the Metro Storm Drain and Missoula Gulch and at the downstream extent of Lower Area One. If unaddressed, these areas will be a continuing source of contaminated water and sediments for downstream reaches.
- Elevated arsenic and metals are present in sediments in the reconstructed portion of Silver Bow Creek. In general, sediments in the upstream reaches of the channel have higher metals concentrations

than sediments further downstream, and it appears that metals are moving downstream.

- The most effective way to reduce risk to the aquatic receptors in Silver Bow Creek is to eliminate, to the extent possible, discharges of contaminated groundwater and storm water runoff from solid media sources on the Butte Hill.

Prior Risk-Based Remediation

The results of the human health and ecological risk assessments prompted EPA to initiate several response actions to protect human health and the environment prior to the completion of the RI/FS.

Human Health Risk

To protect human health, the following response actions were taken:

- **Lead in Soils.** Nearly 26 percent of residential yards sampled had soil lead concentrations that could result in blood lead levels greater than 10 µg/dl. EPA directed the PRP Group to conduct the cleanup to mitigate this potential health threat.

- **Railroad Beds**. Unacceptable arsenic contamination was most closely associated with railroad beds. EPA directed the PRP Group to conduct the Railroad Beds cleanup using the established action levels.

These actions were driven by the specific human health action levels (see adjacent box).

Ecological Risk

Severe, acute aquatic risks were identified in the 1991 risk assessment in Lower Area One. This led to the Lower Area One cleanup, which removed most contaminated materials from the floodplain. Since the assessment was conducted in 1991, numerous response action activities have been conducted at the Butte Priority Soils OU, including:

- Removal of tailings from the Silver Bow Creek floodplain at Lower Area One

- Capture of groundwater and reconstruction of the Silver Bow Creek channel through Lower Area One

- Removal of contaminated soil and mine waste on the Butte Hill

- Construction of engineered caps over contaminated mine waste on the Butte Hill

- Construction of storm water controls on the Butte Hill and at Lower Area One

- Removal of contaminated sediments in the Metro Storm Drain, capture of groundwater, and reconstruction of the surface water channel

Soil and Vapor Action Levels

COC	Exposure Scenario	Conc.
Lead	Residential	1,200 mg/kg
	Non-Residential	2,300 mg/kg
Arsenic	Residential	250 mg/kg
	Commercial	500 mg/kg
	Recreational	1,000 mg/kg
Mercury	Residential	147 mg/kg
	Residential (vapor)	0.43 mg/m^3

These actions removed or otherwise controlled some contaminant sources to Silver Bow Creek, reducing the level of contaminants in the creek and their toxic effects on aquatic receptors. For example, total recoverable copper

concentrations averaged 284 ug/L prior to 1998 and 46.8 µg/L after the source removal. Likewise, zinc levels dropped from 1,083 micrograms per liter (ug/L) to 363 ug/L. These concentrations have dropped from 23 to only 4 times the aquatic life standard for copper. For zinc, the change was from seven to two times the standard. Both were based on an in-stream hardness of 140 mg/L.

Remaining Risk

Although the previous response actions and the residential lead abatement program have reduced human health risks, a tremendous volume of metal-laden mine waste remains unaddressed and continues to threaten human health and impact local groundwater and surface water resources. As a result, the Preferred Alternative builds upon the accomplishments of previous response actions to eliminate or mitigate remaining human and ecological risks.

The Preferred Alternative includes the following major critical elements to address remaining risks:

- A site-wide monitoring and maintenance program for reclaimed sites to ensure permanence of the caps over mine waste.
- Alluvial groundwater collection and treatment and appropriate ARAR waivers and monitoring.
- Additional source removal, capping of mine waste and land reclamation for contaminated solid media. Plus, if funded, continuation of the Lead Abatement Program, with the addition of a limited attic dust component to the residential lead abatement program combined with institutional controls.
- A phased storm water management program combining initial action, aggressive monitoring, source area stabilization, and engineering controls to minimize impacts from storm water runoff and return Silver Bow Creek to its beneficial uses.
- Elevated arsenic and metals occur in stream-bed and bank sediments in Silver Bow Creek at concentrations that present significant risks to aquatic biota. These sediments are most notable within the slag canyon west of Montana Street and within the upper reaches of the Silver Bow Creek channel in Lower Area One and the lower reach of Blacktail Creek. The Preferred Alternative will remove contaminated sediments from the stream channel bottom and stream banks, and adjacent floodplain from above the confluence through the slag canyon to the reconstructed floodplain in Lower Area One.

Slag Canyon, Silver Bow Creek

Cleanup Objectives

The Remedial Action Objectives (RAOs) and goals describe what the proposed cleanup is supposed to accomplish. The following is a description of the RAOs proposed for the Butte Priority Soils OU. These objectives differ for various portions of the OU. EPA has identified human health and environmental objectives and goals for groundwater,

surface water, soils, indoor dust, and mining-related wastes at the OU.

The objectives address the various contaminants of concern, media of concern (soils, groundwater, surface water, etc.), exposure pathways and receptors, and current and likely future land use in the OU. The objectives and Remedial Goals (RGs) were prepared by EPA in accordance with National Contingency Plan (NCP) regulations, relevant guidance, and in consultation with the State.

For soils, surface water, and groundwater, the objectives specify the COCs and the exposure routes and receptors at issue for cleanup. The objectives are followed by preliminary goals in the form of applicable or relevant and appropriate requirements or acceptable levels or ranges of levels for each exposure route.

Soils

Proposed RAOs

The proposed RAOs are to:

- Prevent ingestion of, direct contact with, and inhalation of contaminated soils, indoor dust, waste rock, and/or tailings or other process waste that would result in an unacceptable risk to human health assuming current or reasonably anticipated future land uses.

- Prevent releases of contaminated solid media to the extent that they will not result in an unacceptable risk to aquatic environmental receptors.

- Prevent releases of contaminated water from solid media that would result in exceedences of the Montana State Water Quality Standards for surface water.

- Prevent releases of contaminated water from soil that would result in exceedences of the Montana State Water Quality Standards for groundwater.

- Remediate contaminated solid media to the extent that it will not result in an unacceptable risk to human health and/or aquatic environmental receptors.

- Prevent release of contaminated water from solid media that would result in degradation of surface or groundwater, in accordance with the surface water preliminary RGs.

Proposed RGs

As noted earlier, EPA derived action levels for lead at 1,200 mg/kg in residential yards and play areas (i.e., receptor areas) and 2,300 mg/kg at waste rock dumps or other source areas outside of residential areas to maintain a blood lead level of 10 µg/dl or less for at least 95 percent of the children between the ages of zero and 6 years. These action levels have been used to determine ongoing response actions, including use by Butte-Silver Bow County as part of the lead abatement program.

The EPA action level for arsenic in commercial/industrial areas is 500 mg/kg. The arsenic action level for residential areas and rail beds that transect residential areas is 250 mg/kg. The arsenic action level for open space areas that may be used for recreational purposes is 1,000 mg/kg.

In 2003, EPA finalized an additional evaluation of the potential human health risks to children and adults living in Walkerville related to exposure to arsenic, lead, and mercury in outdoor soil and indoor dust. Based on the results of the Walkerville residential risk analysis, EPA established an indoor residential

action level for mercury vapor of 0.43 µg/m3 and an action level of 147 mg/kg for mercury in residential soil. Previously established residential action levels for arsenic (250 mg/kg) and lead (1,200 mg/kg) were determined to be protective for exposure to indoor dust, and were not changed.

Surface Water

Surface water contaminants of concern are: aluminum, arsenic, cadmium, copper, iron, lead, mercury, silver, and zinc. The exposure pathways for humans are dermal exposure to and ingestion of surface water by recreational visitors (inner tubers). Waterfowl, fish, and benthic macroinvertebrates are also exposed to contaminants in surface water through ingestion.

Proposed RAOs

The preliminary RAOs for contaminated surface water are to:

- Prevent ingestion or direct contact with contaminated surface water that would result in an unacceptable risk to human health.
- Return surface water to a quality that supports its beneficial uses.
- Prevent source areas from releasing contaminants to surface water that would cause the receiving water to violate surface water ARARs and PRGs for the OU and prevent degradation of downstream surface water sources including during storm events.
- Ensure that point source discharges from any water treatment facility (e.g., water treatment plant, wetland, etc.) meet ARARs.
- Prevent further degradation of surface water.
- Meet the more restrictive of aquatic life or human health standards for surface water identified in Circular WQB-7, through the application of B-1 and I class standards, as more specifically described below.

Proposed RGs

The main requirements for the surface water regulations are compliance with Montana's WQB-7 standards. EPA's approach has set as its objective compliance with WQB-7 standards continuously throughout the lowermost reach of Blacktail Creek within the OU (taking into account background contamination) and the entire reach of Silver Bow Creek in the OU and downstream during base flow and storm water conditions.

The State of Montana has designated uses for Silver Bow Creek and has promulgated specific standards accordingly. These standards are usually as stringent as, or more stringent than, federal water quality criteria. The most stringent human health or aquatic water quality criterion is applied. The resulting proposed surface water RGs are shown in the adjacent box. All substantive requirements of the Montana Pollutant Discharge Elimination System must also be adhered to for point sources addressed or created in the remedial process.

One of EPA's primary remedial goals at the Butte Priority Soils OU is to enable the reach of Silver Bow Creek within the OU to function for its beneficial uses, one of which is a self-sustaining trout fishery. This means contaminants in surface water and sediments cannot adversely affect any life stage of these species, including the more sensitive larval and early fry stages, or negatively impact the important prey species consumed by trout (e.g., benthic macroinvertebrates).

Groundwater

EPA found unacceptable risk to human receptors from use and ingestion of contaminated alluvial groundwater at the OU, primarily because of arsenic, cadmium, and lead contamination. Groundwater contaminants of concern are: arsenic, cadmium, copper, lead, mercury, and zinc.

The proposed RAOs and RGs associated with groundwater are based on EPA's determination that restoration of the contaminated alluvial aquifer is not feasible or technically practicable. Protection of health and the environment can be obtained through EPA's Preferred Alternative through the implementation of institutional controls and interception and treatment of the contaminated groundwater such that surface water objectives and goals are met.

Preliminary RAOs

Accordingly, the proposed RAOs for contaminated groundwater are:

- Prevent ingestion of or direct contact with contaminated groundwater that would result in unacceptable risk to human health.
- Prevent groundwater discharge that would lead to violations of surface water ARARs and preliminary RGs for the Butte Priority Soils OU.
- Prevent degradation of groundwater that exceeds current standards.
- Ensure that any system is designed to capture and treat flows adequately over time and is monitored carefully.

Surface Water Quality Standards

COC[1]	WQB-7Standard	Standard (Total[2])
Aluminum[3]	Acute Chronic	750 µg/L 87 µg/L
Arsenic[4]	Acute Chronic Human Health	340 µg/L 150 µg/L 10 µg/L
Cadmium	Acute Chronic Human Health	1.05 µg/L * 0.16 µg/L * 5.0 µg/L
Copper	Acute Chronic Human Health	7.3 µg/L * 5.2 µg/L * 2,300 µg/L
Iron	Chronic	1000 µg/L
Lead	Acute Chronic Human Health	82 µg/L ** 3.2 µg/L ** 15 mg/L
Mercury	Acute Chronic Human Health	1.7 µg/L 0.91 µg/L 0.05 µg/L
Silver	Acute	4.1 µg/L **
Zinc	Acute Chronic	67 µg/L * 67 µg/L *

* @ harness of 50 mg/L
** @ hardness of 100 mg/L

Notes
1) Contaminant of Concern
2) The values provided at a reference hardness may vary and are dependent on hardness (Montana Numerical Water Quality Standards, Circular WQB-7, January 2004). Note that the cadmium standards have changed relative to those presented in the Phase II RI Report and the September 2003 ARARs identification (2.067 µg/L acute and 1.429 µg/L chronic).
3) The WQB-7 standards for aluminum refer to the dissolved fraction
4) The Federal standard (MCL) is listed for arsenic. The State standard is 18 µg/L.

Summary of Remedial Alternatives

This section presents EPA's alternatives for achieving its proposed objectives at the Butte Priority Soils OU. It briefly

describes the alternatives studied, their interaction with past remedial actions, their common elements, and how they differ from one another. It also presents the estimated costs for each alternative.

The Alternative Development Process

EPA screened potential cleanup technologies as the first phase of the FS. The screening process identified all the technologies that were potentially feasible for treating or remediating inorganic contaminants in groundwater, surface water, sediment, and soil/mine waste. It then evaluated the identified technologies for their effectiveness and implementability.

The FS report considered a wide range of media-specific remedial alternatives and special geographic and land use components within the OU. Each geographic or land use component identified for consideration in the FS contained its own unique set of characteristics, including factors such as proximity to surface water bodies or groundwater, potential to impact storm water quality, ground and surface water interaction, potential for development or other uses, or historical significance.

In 2003, EPA began a more detailed evaluation of cleanup alternatives for the Metro Storm Drain than the PRPs. EPA incorporated this into the FS titled *Focused Feasibility Study*.

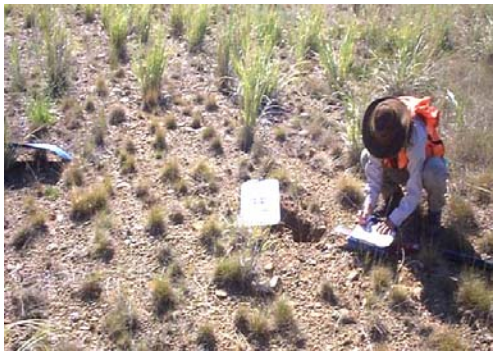
Integration of Past Response Actions

EPA requires past response actions to be designed and constructed in a manner consistent with a final remedy. Superfund requires EPA to ensure an orderly transition from removal action to remedial action. Before deciding if past response actions would be compatible with the final remedy, EPA evaluated whether the past response actions were consistent with the cleanup objectives. That assessment was published in the Response Action Summary Document. The assessment found that most past removal actions complied with standards called ARARs and were consistent with cleanup objectives.

Based on the Response Action Summary Document and the administrative record for past response actions, EPA granted a conditional, limited no further action status to all past response action sites, except the Colorado Smelter removal site, Lower Railroad Yard Site 1, and the Lower Area One removal site.

EPA or the State may still select additional actions in the final cleanup plan to address protectiveness issues. These include: specific management practices, storm water controls, groundwater protection measures, and cap modifications.

EPA has also developed the Butte Reclamation Evaluation System to ensure that reclaimed areas will remain stable and protective. Under this system, proposed performance standards have been developed to evaluate the integrity of the cap, run-on and runoff controls, and the adequacy of vegetation.



Field testing the Butte Reclamation Evaluation System

Institutional Controls (ICs) are a component of every alternative. They are

necessary to protect the remedy and human health. ICs specific to the Preferred Alternative are discussed in this Proposed Plan. Further details on ICs will be provided in the ROD.

Detailed operation and maintenance of these sites will be required, and the sites are also subject to five-year reviews to ensure that the cleanup actions remain protective. EPA believes this system will ensure long-term effectiveness and permanence for all capped wastes.

List of Alternatives

For simplicity, the description of alternatives is separated into site-wide and Metro Storm Drain remedial alternatives. The comparison between alternatives integrates the Metro Storm Drain alternatives with the site-wide alternatives; these are then referred to as the "comprehensive" alternatives.

Site-Wide Alternatives

The site-wide alternatives developed for the OU are:

- **Alternative 1 -** No Further Action
- **Alternative 2 -** Covers/Partial Removal for Solid Media, Treatment of Lower Area One Groundwater, Surface Water best management practices (BMPs), ICs, and Monitoring
- **Alternative 3 -** Covers/Partial Removal/Limited Treatment for Solid Media, Groundwater Collection and Redirection to the Berkeley Pit, Surface Water BMPs, ICs, and Monitoring
- **Alternative 4 -** Covers/Partial Removal/Limited Treatment for Solid Media, Groundwater Collection and Lime Treatment, Surface Water BMPs, ICs, and Monitoring
- **Alternative 5** - Covers/Partial Removal/Limited Treatment for Solid Media, Groundwater Source Material Partial Removal/Collection and Lime Treatment, Surface Water BMPs, ICs, and Monitoring
- **Alternative 6** - Source Material Removal, Groundwater Source Material Removal/Collection and Lime Treatment, Surface Water BMPs, ICs, and Monitoring

Metro Strom Drain Area Alternatives

These alternatives were developed to augment the site-wide alternatives. Each consists of water treatment and/or waste removal options. Groundwater collection and treatment is intended to prevent discharge of contaminated base flow to Silver Bow Creek. Source removal options are intended to remediate alluvial groundwater within the Metro Storm Drain area.

- **Alternative 1**: No Further Action
- **Alternative 2** - Capture and Treatment of Metro Storm Drain Base Flow
- **Alternative 3** - Removal of Accessible Diggings East and North Side Waste Materials. Accessible waste material, (92,580 cubic yards with 35,750 cubic yards of overburden) would be removed.
- **Alternative 4** - Combination of Alternatives 2 and 3: Groundwater Capture and Treatment with Removal of Diggings East and North Side Tailings. Accessible waste material, (92,580 cubic yards with 35,750 cubic yards of overburden) would be removed.
- **Alternative 5a** – Removal of All Accessible Waste Material in the

Metro Storm Drain with Groundwater Capture and Treatment. Total of 480,949 cubic yards of waste and 83,192 cubic yards of overburden from Parrott Tailings and Metro Storm Drain below Harrison (North Side Tailings, Diggings East Tailings, and the Lower Metro Storm Drain).

- **Alternative 5b** – Removal of Accessible Waste Material in the Metro Storm Drain with Removal and Reconstruction of the City-County Shops and Groundwater Capture and Treatment. Total of 779,684 cubic yards of waste and 103,735 cubic yards of overburden from Parrott Tailings and Metro Storm Drain below Harrison Avenue (including the North Side Tailings, Diggings East Tailings, and the Lower Metro Storm Drain).

- **Alternative 6** – Total Removal of All Waste in the Metro Storm Drain with Groundwater Capture and Treatment. Total removal is 1,397,161 cubic yards of waste with 775,832 cubic yards of overburden for the entire area. All buildings, including residences and a shopping center, would be removed.

Metro Storm Drain

Common Elements in the Site-Wide Alternatives

The different site-wide alternatives have many elements in common. These are described briefly below.

- **Operation and Maintenance/ Corrective Actions**. All alternatives require long-term operation and maintenance of waste covers, solid media, and vegetation consistent with standards set in the Butte Reclamation Evaluation System. Areas which were reclaimed, but not under an EPA Order, would be inspected and/or sampled to determine whether previous actions are protective or additional actions are warranted. Operation and maintenance of the Lower Area One collection system and storm water TCRA system would continue. Monitoring of storm water and groundwater would continue.

- **Institutional Controls**. All of the alternatives require the use of institutional controls to limit access to solid media and groundwater and maintain the integrity of the cleanup.

- **Covers.** Alternatives 2, 3, 4, and 5 specify the use of soil and rock covers with revegetation or asphalt or concrete covers for areas exceeding lead and arsenic action levels. Multimedia covers would also be used under specific conditions. Consolidation of wastes and grading is also specified for these areas.

- **Volume of Material Removed.** Alternatives 2, 3, 4, and 5 specify partially removing areas exceeding lead and arsenic action levels. Areas which were reclaimed, but not under an EPA Order, would be evaluated and/or sampled to determine whether previous actions are protective or additional actions will be required.

Residential soils exceeding lead, arsenic, or mercury action levels would be cleaned up with an approach similar to the Lead Intervention and Abatement Program.

- **Reclamation of Specific Areas**. Reclamation would be conducted for the area adjacent to the Granite Mountain Memorial Area. The Syndicate Pit would be minimally reclaimed to allow site reuse as a mine training center. A vegetated berm would be constructed on the west rim with trees. No other areas within the pit would be reclaimed. Surface water controls (e.g., curbs and gutters) would direct storm water to the Syndicate Pit. The pit base would continue to be used as a sediment catch basin.

- **Treatment of Wastes**. Alternatives 3, 4, and 5 specify the use of waste treatment of mine wastes that fail toxicity characteristic leaching potential (TCLP) testing to reduce toxicity and mobility.

- **Indoor Residential Contamination.** Alternatives 3, 4, and 5 specify soil and dust sampling and clean up, an attic dust program, and other actions to reduce human health risk.

- **Closure of Waste Repository**. All alternatives specify the closure of the waste repository and siting of new repositories as necessary.

- **Storm Water BMPs.** All alternatives except no action require use of specific types of management, where appropriate. This may include source removals and controls, engineering controls, sedimentation basins, and routing. A phased approach would be used to determine the need for these management techniques. If options for management techniques don't help to achieve water quality standards, storm water would be treated with lime, in order to meet water quality standards in Silver Bow Creek and other relevant waters.

- **Sediment Removal**. All alternatives, except no action, specify the removal of sediments and bank/overbank material from Silver Bow Creek in the reach from the confluence of Blacktail Creek and Metro Storm Drain to the point in Silver Bow Creek where the stream was reconstructed at Lower Area One.

- **Collection of Storm Water Runoff and Treatment**. All alternatives, except no action, specify that storm water runoff will be collected and treated or directed to the Berkeley Pit, if BMPs do not achieve cleanup goals.

- **Collection, Routing, and Treatment of Groundwater.** All of the alternatives specify that groundwater collected at Lower Area One (in the hydraulic control channel and hydraulic control pond CT-04) would be treated. The difference is in the type of treatment and the routing. Alternatives 4, 5, and 6 specify treatment by lime precipitation and discharge to Silver Bow Creek.

Metro Storm Drain

- **Waste Removal.** Alternatives 3, 4, 5a, 5b, and 6 all require some volume of waste removal. The difference is whether the removal is limited to removal of accessible wastes or if structures will be removed to excavate otherwise inaccessible wastes.

Distinctions between Alternatives

The following is a description of the elements that make each alternative unique, these elements may include

RAOs to be achieved, estimated quantities of material to be removed, implementation requirements, key ARARs, future land use, estimated time to complete, or estimated costs.

Site-Wide Alternatives

- **Cost**. Costs vary widely with each alternative. Estimated present value costs for each alternative are presented in the *Evaluation of Alternatives (*page 36).

- **Operation and Maintenance**. Alternatives that call for total removal of upland solid media source areas, residential yards, and contaminated interior and/or attic dust will require less operation and maintenance and/or institutional controls. If contaminated materials are completely removed, there will be no need for future programs to address contaminated solid media. This does not include floodplain wastes. It is EPA's position that even if floodplain wastes in the Metro Storm Drain and/or Lower Area One could be completely removed, groundwater capture and treatment and associated operation and maintenance would be required over the long-term.

- **Volume of Material Removed**. The volume of waste removed varies with each alternative. For Alternative 1, no more waste would be removed. Alternative 6 specifies total removal for areas exceeding lead and arsenic action levels. Because *all* contaminated materials will be removed, no covers would be specified. The Granite Mountain Memorial Area would be regraded and covered. All slopes in the Syndicate Pit area would be regraded and capped with soil, and the site would *not* be used as mine training center or as a sediment basin.

- **Lead Abatement Program.** For Alternative 1, the lead abatement program would be discontinued.

- **Indoor Residential Contamination.** Alternatives 1 and 2 have no provisions for indoor residential contamination. Alternative 6 specifies a one-time cleaning of the residential interior at properties undergoing yard cleanup or as part of a program to reduce the risk from dust during remodeling activities.

- **Collection, Routing, and Treatment of Groundwater**. Three of the alternatives (4, 5, and 6) call for lime treatment of Lower Area One groundwater and discharge to Silver Bow Creek. Alternatives 1 and 2 specify treatment with lime in lagoons in a wetland setting during treatability studies prior to being discharged to Silver Bow Creek. Alternative 3 specifies that the groundwater would be collected and conveyed via pipeline to the Berkeley Pit or Berkeley Pit treatment plant for combined treatment with water from the Berkeley Pit.

- **Use of Extraction Wells**. Alternative 6 would add the use of extraction wells installed at the west end of Lower Area One to minimize migration of contaminants.

- **In-stream Flow Augmentation.** Alternative 2 specifies that groundwater base flow in the Metro Storm Drain would not be treated but would be augmented with clean water so that water quality standards are met in Silver Bow Creek

Metro Storm Drain

- **Volume of Material Removed**. Alternatives 3, 3, 5a, 5b, and 6 require some volume of waste

removal. Alternatives 3 and 4 both remove only accessible wastes (92,580 cubic yards with 35,750 cubic yards of overburden). Alternative 5a broadens the removal area to include the Parrott tailings (except those under the City-County Shops) for a total of 480,949 cubic yards of waste and 83,192 cubic yards of overburden. Alternative 5b removes the City-County Shops to access more of the Parrott tailings (480,949 cubic yards of waste and 83,192 cubic yards of overburden). Alternative 6 removes all surface structures (including a shopping center and residences) and removes a total of 1,397,161 cubic yards of waste with 775,832 cubic yards of overburden.

Evaluation of Alternatives

This evaluation helps explain EPA's rationale for selecting the Preferred Alternative. It includes a discussion of nine criteria EPA uses in the FS to evaluate alternatives. The evaluation was intended to identify the relative advantages and disadvantages of each alternative, consider the tradeoffs of each, and explain EPA's selection of a Preferred Alternative. A detailed evaluation of how each of the remedial alternatives fared against each of the criteria can be found in the FS report.

The comparison focused on the significant areas of difference, especially the identification of any alternative that is clearly superior. To develop the comprehensive alternatives, the Metro Storm Drain alternatives were integrated into site-wide alternatives (see adjacent box).

For example, Comprehensive Alternative 3 includes the components of Site-wide Alternative 3 and Metro Storm Drain Alternative 2. Similarly, Comprehensive Alternative 5 includes the components of

Integrated Site-wide Alternatives

Comprehensive Alternative =A+B	Site-Wide (A)	Metro Strom Drain (B)
1	1	1
2	2	1
3	3	2
4	4	2
5	5	3, 4, 5A, 5B
6	6	6

Site-wide Alternative 5 and Metro Storm Drain alternatives 3, 4, 5A, and 5B. The table on page 36 provides a visual summary and numeric scoring of the six comprehensive alternatives. These alternatives above can be recombined to achieve greater protectiveness of alluvial groundwater.

The evaluation criteria fall into three groups:

- **Threshold criteria.** Requirements that each alternative *must* meet in order to be eligible for selection. They are 1.) overall protection of human health and the environment and 2.) compliance with ARARs (unless a waiver is justified).

- **Primary balancing criteria**. Used to weigh major trade-offs among alternatives. They are: 3.) long-term effectiveness and permanence; 4.) reduction of toxicity, mobility, or volume through treatment; 5.) short-term effectiveness; 6.) implementability; and 7.) cost.

- **Modifying criteria**. Considered to the extent that information is available in the FS, but can be fully considered only after public comment is received on the Proposed Plan. These are of equal importance to balancing criteria in final remedy selection. They are: 8.) community acceptance and 9.) State acceptance

Evaluation of Alternatives

	Alternatives	Protection of Human Health and the	Compliance with ARARs	Long-Term Effectiveness and Permanence	Toxicity, Mobility or Volume Through	Short-Term Effectiveness	Implementability	Overall Score	Costs ($ Millions)
1	No Further Action	◐	◔	○	○	◐	●	15	9
2	Covers/Partial Removal for Solid Media, MSD Flow Augmentation, Treatment of LAO Groundwater, Sediment Removal in Silver Bow Creek, Surface Water BMPs (including treatment), ICs and Monitoring.	◕	◕	◕	◔	●	◕	23	32 - 52 [a]
3	Covers/Partial Removal and Limited Treatment for Solid Media, LAO and MSD Groundwater Collection and Redirection to the Berkeley Pit, Surface Water BMPs (including Treatment), ICs and Monitoring.	●	◕	●	◔	●	◐	24	41 - 57 [a]
4	Covers/Partial Removal and Limited Treatment for Solid Media, Lower Area One and Metro Storm Drain Groundwater Collection and Conventional Lime Treatment, Sediment Removal in Silver Bow Creek, Surface Water Best Management Practices (including treatment if necessary), Institutional Controls, and Monitoring	●	◕	●	◔	●	◕	25	39 - 56 [b]
5	Covers/Partial Removal and Limited Treatment for Solid Media, Range of Partial Removal Options for Groundwater Source Material in MSD/LAO and MSD Groundwater Collection and Lime Treatment, Sediment Removal in Silver Bow Creek, Surface Water BMPs (including Treatment), ICs and Monitoring.	●	◕	●	◔	◐	◐	22	40 - 100 [c]
6	Solid Media Removal of unreclaimed areas, Groundwater Source Material Removal/LAO and MSD Groundwater Collection and Lime Treatment, Sediment Removal in Silver Bow Creek, Surface Water BMPs (including Treatment), ICs and Monitoring.	◕	◕	●	◔	○	○	17	241 - 262 [a]

● High achievement of criterion. Score = 5 points

◕ Moderate to high achievement of criterion. Score = 4 points

◐ Moderate achievement of criterion. Score = 3 points

◔ Low to moderate achievement of criterion. Score = 2 points

○ Low achievement of criterion. Score = 1 point

a. Low range indicative of groundwater treatment in existing Lower Area One Treatment Lagoons in a Wetland Setting and no storm water treatment. High range indicates lime treatment of both groundwater and storm water in separate and distinct conventional treatment plants.

b. Low range indicative of groundwater treatment in new conventional treatment plant at Lower Area One and no storm water treatment. High range indicates lime treatment of both groundwater and storm water in separate and distinct conventional treatment plants.

c. Low range indicative of groundwater treatment in existing Lower Area One Treatment Lagoons in a Wetland Setting, removal of Diggings East and North Side Tailings only in Metro Storm Drain, and no storm water treatment. High range indicates lime treatment of both groundwater and storm water in separate and distinct conventional treatment plants, and maximum removal of accessible wastes in Metro Storm Drain (including wastes beneath City-County Shop).

Note: DEQ does not concur with the characterization of long-term effectiveness and permanence

The following is a discussion of how each of the remedial alternatives fared in the evaluation against these three categories of criteria.

Threshold Criteria

Overall Protection of Human Health and the Environment

Alternative 1 does not meet the threshold criteria for protection of human health and the environment. EPA believes that Comprehensive Alternatives 3, 4 and 5 will provide a high level of achievement in meeting this criterion. Alternative 2 is expected to perform at a slightly lower level because it would not include interior residential living space actions and because flow augmentation of Metro Storm Drain base flow would have less certainty in consistently meeting standards than collection and treatment. Alternative 6 is predicted to have a moderate to high achievement of this criterion. Although it would provide a high level of long-term protection, it would have greater short-term risks than the other alternatives due to the relatively large-scale nature of these actions.

Compliance with ARARs

The ability of the alternatives to meet contaminant-, location- and action-specific ARARs was evaluated. Alternative 1 would not meet ARARs. Alternatives 2, 3, 4, 5, and 6 would all meet ARARs, except for groundwater within the alluvial aquifer.

EPA does not believe that any of the removal alternatives at the Metro Storm Drain would lead to groundwater ARAR compliance in the next 100 years, because of the low flow rates and abundance of waste in the area. Under any scenario, a waiver of applicable groundwater standards is necessary (Montana WQB-7 human health standards for groundwater and the Federal MCL for arsenic).

EPA proposes to waive groundwater standards within the alluvial aquifer under NCP Section 121(4)(c), and CERCLA Section 300.430 (f)(1)(ii)(c)(3). EPA believes that it is not technically feasible to meet ARAR requirements within this aquifer because of the widespread contamination and the very slow overall movement of water flow within the aquifer.

Primary Balancing Criteria

Long-Term Effectiveness and Permanence

Alternatives were evaluated with regard to residual risk and the adequacy of controls as follows:

- **Magnitude of Residual Risk.** Future effects on human health and the aquatic ecosystem from exposure to contaminated soils/mine waste, groundwater, and surface water.

- **Adequacy and Reliability of Controls**. Use and adequacy of controls and best management practices.

EPA concluded that Alternatives 3 through 6 would provide a high level of long-term protection. EPA believes that the detailed Butte Reclamation Evaluation System and monitoring program can ensure that risks are managed effectively with wastes left in place. Alternative 2 would provide a moderate to high level of long-term effectiveness and permanence, because there is less certainty that water quality standards would be met in portions of Silver Bow Creek under base flow conditions than the other alternatives, which include collection and treatment of groundwater.

Alternative 6 provides a higher level of permanence because the removal of

wastes is somewhat offset by a slightly lower level of protection than Alternatives 3, 4, and 5 because this alternative does not include the Lead Abatement Program, and there is no provision to abate non-mining sources of lead, such as interior lead-based paint.

Reduction of Toxicity, Mobility, or Volume through Treatment

This criterion evaluated the alternatives based on the effectiveness of:

- physically removing mine waste and contaminated soil;
- capping of contaminated media in-place;
- capturing and treating contaminated water; and
- implementing best management practices, institutional controls, and monitoring programs of reducing toxicity, mobility, or volume.

Since little active treatment of contaminated media would occur under any of the alternatives, EPA predicted that the alternatives would have a low to moderate ability to meet this criterion. Although the alternatives contain treatment components that will reduce toxicity, mobility and volume (e.g., groundwater collection and treatment with lime), most remedial components use cover, removal, and administrative or engineering controls to limit mobility. Alternatives which remove wastes rate higher for reduction of mobility, especially in the Metro Storm Drain.

The vast majority of mine wastes and contaminated soils are of large volume and low contaminant of concern concentration, which would be difficult to treat effectively. In addition, technical difficulties prevent effective treatment of the various metals present. Thus, active treatment was screened-out as a potential option for the solid media.

Short-Term Effectiveness

Evaluation of alternatives under this criterion included consideration of the following sub-criteria:

- **Protection of Community and Cleanup Workers during Cleanup**. The volume of materials to be dealt with under each alternative and the time/safety elements. Alternatives involving in-place controls and less removal can be implemented quicker and with less construction activity and fewer traffic problems, and are considered more implementable.

- **Environmental Impacts of Implementation.** Impacts on aquatic ecosystems.

- **Time until Cleanup Objectives are Achieved.** How long it would take each remedial action to achieve objectives and goals.

EPA concluded that Alternatives 2, 3 and 4 would have a high level of achievement of this criterion. Implementation of any of these alternatives would result in a low level of risk to the community, cleanup workers, and the environment.

Construction activities are performed with standard equipment, such as excavators and trucks. This type and scale of construction has been used extensively and poses low risks to workers and to the community at large. Alternatives 5 and 6 would have an increasingly low ranking under this criterion.

Other risks, such as those from dust emissions and storm water runoff, also pose low risks under Alternatives 2, 3, and 4. Dust can be easily controlled using common engineering and construction techniques (e.g., water spray) and migration of storm water can be readily mitigated using standard

BMPs. Actions for groundwater (ICs, collection of Metro Strom Drain base flow, and redirection to a treatment plant) would require minor construction activities in the vicinity of the Metro Storm Drain and Lower Area One and would pose a low risk.

Of the five action alternatives evaluated in the FS, the predicted implementation time until protection is achieved is the shortest for Alternatives 3 and 4. Alternative 5 and 6 are predicted to have a moderate and low achievement of this criterion, respectively, due to the total volume of waste material to be removed.

Implementability

Implementability is evaluated using the following sub-criteria:

- **Technical Feasibility.** The ability to conduct and operate the technology, time required for remedial implementation, reliability of the technology, ability to monitor the effectiveness of the technology, and ease of undertaking additional action should it be necessary.

- **Administrative Feasibility.** The ability to obtain approvals and coordinate with state and federal regulatory agencies, municipalities, and counties.

- **Availability of Services and Facilities**. The availability of needed equipment, specialists, materials (e.g., backfill and cover soil), and location and size of area for disposal of waste and contaminated soils.

Most alternatives would use standard construction equipment and controls. Covering and partial removal of source materials and remediation of residential yards has proven technically feasible. Groundwater flow augmentation, collection, and redirection to the Berkeley Pit or collection and lime treatment (components of Alternatives 2 through 4) are expected to be readily implementable from a technical perspective.

EPA believes Alternatives 2 and 4 would have a moderate to high level of implementability, while Alternatives 3 and 5 would have a moderate level of implementability.

Alternative 6 is expected to have a low level of implementability as total removal of saturated solid media from Lower Area One and Metro Storm Drain would require demolition and replacement of numerous structures, including Metro Sewage Treatment Plant, Butte Civic Center, and other business/commercial operations. These operations would have to be relocated before saturated solid media removals could be implemented. It is likely that access for this type of work would be very difficult and expensive, as it would severely disrupt businesses over a five- to ten-year period.

Cost

Net present worth costs for each alternative were compared (see the comparison of alternatives table on page 36). The range of costs for each alternative represents the range of possible scope of actions to address mine waste and contaminated soil on the Butte Hill, storm water runoff, the treatment of collected groundwater, and different Metro Strom Drain waste material options.

EPA believes that Alternative 6 and portions of Alternative 5 which address Metro Storm Drain removal would not rank well under the cost-effectiveness criterion because they would not achieve benefits (cleanup of the aquifer) with certainty and yet would have difficult implementability issues and would be very costly. Removal of the Metro Storm Drain wastes may not meet groundwater

RGs and would not eliminate the need for groundwater collection and treatment.

Remedial Alternative Scores

Based on the comparative evaluation of the alternatives against the threshold and balancing criteria, Alternatives 2, 3, 4, and 5 scored similarly. Alternative 6 scored significantly lower than the other alternatives primarily due to the increased risks during remediation and the difficulty of implementing a complete removal of waste material.

Modifying Criteria

Community and State Acceptance

The FS examined the seven threshold and balancing criteria. The remaining two criteria, community and state acceptance will be more completely evaluated after public comment on the Proposed Plan is received.

EPA has indications where the community and the State stand on the Preferred Alternative. Detailed positions from citizen's groups, Butte-Silver Bow County, the PRP Group, the State Natural Resources Damages program, the State, and the Tribes were submitted to EPA as part of a National Remedy Review. EPA believes the Preferred Alternative has community support for many aspects of the plan and that the Preferred Alternative is similar to the submittal from Butte-Silver Bow County.

The State disagrees with EPA's proposed remedy for Metro Storm Drain because the State believes it leaves a significant permanent threat to the cleanup of Silver Bow Creek and relies on institutional controls to ensure that local residents never drink contaminated groundwater. The State is committed to the policy of removing major sources of water pollution and has demonstrated their commitment at the Silver Bow Creek/Butte Area NPL Site.

The State believes that significantly more weight should be given to Metro Storm Drain Alternative 5b, which calls for removing the major sources of groundwater contamination (the Parrott Tailings, Diggings East, and the North Side Tailings). It is their belief that such removal would substantially reduce toxicity, mobility, and volume of groundwater contamination and greatly increase the permanence and long-term effectiveness of the remedy for this highly-contaminated groundwater area. With the degree of uncertainty surrounding the question of whether the aquifer would clean up in a reasonable period of time following waste removal, the State prefers the more protective approach of removing the major sources of contamination.

Preferred Alternative

The Preferred Alternative is comprised of a slightly modified version of comprehensive Alternative 4, which is a combination of site-wide Alternative 4 and Metro Storm Drain Alternative 2.

The Preferred Alternative is modified from Alternative 4 in that it eliminates further consideration of groundwater treatment utilizing the lime treatment in a wetland setting technology. Under the Preferred Alternative, groundwater will be treated in a conventional lime treatment plant.

Relative to the threshold and balancing criteria, the Preferred Alternative scored higher overall than other alternatives and had higher or equal achievement of each of the individual criteria. It is judged to have high achievement of overall protection of human health and the environment and moderate to high achievement for compliance with ARARs. An ARAR waiver for the alluvial

groundwater will be required and is appropriate for this site. Also, the Preferred Alternative is cost-effective relative to other comprehensive alternatives in that it achieves the highest level of long- and short-term effectiveness and implementability for the most reasonable cost.

This cleanup will address human health risks associated with high-volume, low-toxicity mine waste in Butte. It will eliminate contaminants introduced to Silver Bow Creek by groundwater, sediment, and storm water runoff from the Butte Hill.

Description of Preferred Alternative

The Preferred Alternative includes components to address human health and environmental risks associated with contaminated soils, surface water, and alluvial groundwater.

Solid Media Components

Contaminated soils remaining at the Butte Priority Soils OU above the action levels (page 25) will be addressed through a combination of source removal, capping, and land reclamation. Arsenic, lead and mercury contamination in residential settings above the action levels will be addressed through a continuation of the existing Lead Abatement Program, with the addition of a limited component to address attic dust, if this program is fully-funded by the PRP Group.

This program is partially voluntary. If it is not fully-funded, then the ROD will require a comprehensive sampling of all residential areas and cleanup of yards and indoor dust which exceed the action levels. Similarly, attic dust would be sampled and cleaned up if above action levels and if residents indicate plans to use the attic for extended time periods.

The existing Butte Mine Waste Repository will be closed in compliance with ARARs. A new repository will be sited next to the existing repository if that capacity is needed. It, too, would be closed using the same standards.

Reclaimed areas, including cover soil caps, must achieve the proposed performance standards described by EPA in the Butte Reclamation Evaluation System. This system is a site-specific tool to evaluate the stability, integrity, and degree of human and environmental protectiveness afforded by EPA-sanctioned response actions initiated on lands impacted by mining within the OU.

When finalized and approved, the Butte Reclamation Evaluation System will establish a system for evaluating reclaimed and revegetated land, relying on routine inspections to assess the:

- condition and diversity of vegetative cover
- presence of erosion
- condition of site edges
- presence of exposed waste material
- presence of bulk soil failure or mass instability
- presence of barren areas or gullies

It will also set corrective action triggers for each parameter. Vegetated cover soil caps must support a diverse plant community including native species to the extent that the constituents of the vegetation cover are not incompatible with the remedy.

Sites with contaminated soil are grouped into different categories for remedial action as follows:

- Conditional, limited no further action sites

- Unreclaimed source areas exceeding arsenic and/or lead action level(s)

- Unreclaimed source areas not exceeding arsenic or lead action levels but which impact surface water quality
- Previously reclaimed sites that were not addressed under EPA Order
- Sites within the Granite Mountain Memorial Area
- Syndicate Pit
- Targeted multi-pathway approach for residential areas
- Buried and/or saturated solid media
- Sites that were not granted a "conditional, limited no further action" status in the Response Action Summary Document

Conditional, Limited No-Further Action Sites

Areas of the OU that have been reclaimed during previous cleanups and that were determined to have met standards and cleanup objectives in the Response Action Summary Document will require periodic assessments of reclamation condition and corrective action as dictated by the final Butte Reclamation Evaluation System. If the BMP program determines additional remediation is needed, that work must be done.

Unreclaimed Source Areas Exceeding Action Levels

Very few unreclaimed source areas remain with arsenic or lead concentrations greater than human health risk action levels. Areas that do remain will be capped similar to prior actions – some removal may be necessary for contouring reasons. Remaining source areas at the OU that exceed the lead or arsenic action levels include:

- Goldsmith Dumps Site 161
- Arctic Site 1530
- Wake Up Jim Site 1615[2]
- Small waste areas surrounding Clark Mill Tailings repository
- Caledonia Street
- Moose Dump Site 12

Also, when any new source areas are identified that exceed the risk-based action levels for lead and/or arsenic they will be remediated.

Unreclaimed Source Areas Not Exceeding Action Levels

If an unreclaimed, disturbed site does not exceed lead or arsenic action levels, they may still be reclaimed because of contributions to storm water contamination. EPA, in consultation with the State, has determined that at least the following list of sites will be addressed as an initial BMP effort under the Preferred Remedy:

- Back Fill 007 Site 65
- Unnamed Dump Site 148
- New and Mahoney Street
- 413 Boardman Street
- Jenny Dell Site 33
- Kelley Mine Yard Entrance
- North Wyoming Street
- 800 North Main
- North Corner of Granite and Arizona
- Green Mountain Shaft[2]
- Streambanks, sediment and over bank deposits from and including the Blacktail Creek/Metro Storm Drain confluence area to Lower Area One
- 424 North Washington Street
- 131 West Copper Street

If it is demonstrated by the surface water monitoring and BMP program that contaminants of concern (i.e., copper and zinc) from other areas are migrating

[2] These sites will be addressed pursuant to the final design for the Granite Mountain Memorial Interpretive Area.

off-site and impacting surface water quality in Silver Bow Creek, Blacktail Creek, or Grove Gulch Creek, to the extent that applicable water quality standards are exceeded, remedial actions will be implemented. The action to be implemented will be determined during design, but will likely be capping with limited removal and reclamation.

Previously Reclaimed Sites (Not Addressed Under EPA Order)

Sites where reclamation took place outside of removal actions mandated by EPA will require sampling/inspection and possible further reclamation, as necessary. Specific actions to be implemented will be determined during design, but will likely be capping with limited removal. These sites will also be evaluated and maintained over the long-term under the Butte Reclamation Evaluation System.

Granite Mountain Memorial Area

Various reclamation and other enhancements to the historic Granite Mountain Memorial Area will be implemented. These include: reclaiming source areas in publicly used areas, restricting access to certain areas of the historic mining landscape, installing picnic areas and walking trails, enhancing existing vegetation, and diverting storm water runoff to the Berkeley Pit. These actions will be consistent with historical preservation requirements and other standards and the county's historical park plan.

Syndicate Pit

The Syndicate Pit will be reclaimed to the extent practicable, for use as a mine training center. Shallow to moderate slopes will be reclaimed using soil caps, rock caps, and gravel parking areas. Steep slopes will not be reclaimed. The pit base will continue to be used as a sediment catch basin.

Residential Areas

If fully funded, residential cleanup will be implemented through a program similar to the Lead Intervention and Abatement Program currently performed by the Butte-Silver Bow County Health Department. This program uses blood-lead testing; tracking of the residence locations of sensitive populations; and sampling of multiple paths of exposure (including residential soil, paint, dust, and water) to target areas for remediation. The results are used to determine the type of action necessary (yard soil removal, paint removal or installation of siding, water pipe replacement, etc.).

To meet CERCLA requirements, the programmatic approach must provide for sampling of all residential properties within a reasonable time frame. Yards and indoor dust areas above the human health action levels must also be remediated within a reasonable time frame. Since the programmatic approach includes interior lead-based paint and lead pipes, which are not covered under CERCLA, there will be a voluntary agreement among PRPs to fund and implement this programmatic approach.

The Preferred Alternative will thus use a multi-pathway approach to address sources of lead, arsenic, and mercury vapor within the interiors of homes. Actions will be taken to mitigate any identified unacceptable exposures in interior living spaces. They might include carpet cleaning or replacement and dust removal from interior living spaces, mitigation of interior lead-based paint, attic dust control and removal services as requested by home owners planning a remodeling effort, and soil removal or capping in earthen basements.

Accessible surface and near-surface yard soils with concentrations greater than action levels of 1,200 mg/kg lead, 250 mg/kg arsenic, or 147 mg/kg mercury will be removed to a maximum

depth of 18 inches and replaced with clean soil or other suitable fill on a priority basis. The yards will be restored to their approximate pre-cleanup condition. Inaccessible soil (i.e., beneath permanent structures, pavement, etc.) will be left in place.

As part of the multi pathway approach, attic dust control and removal services will be provided to home owners planning a remodeling effort or whenever a pathway of exposure is identified. The attic dust program will be advertised locally and will be included in information provided to participants in the program. If possible, dust in attics or walls that would be affected by remodeling activities would be removed prior to any construction. However, if remodeling uncovers unanticipated dust in the wall or ceiling that dust will be removed. The attic dust program will employ a variety of methods to prevent the release of dust from remodeling activities into the living space, such as HEPA vacuums or ventilators, containment systems, or encapsulating materials.

The following sites are identified under the Preferred Remedy to be addressed immediately as part of the multi-pathway approach:

- Anaconda Sampling Works Site 137
- PA012 Dump Site 113
- 33 West Missoula.

Other residential areas will be addressed in the future if deemed necessary and appropriate by the guidelines established for the residential contamination multi-pathway abatement program.

If an acceptable programmatic approach and agreement are not reached and fully funded, EPA's Preferred Alternative would instead include requirements for conventional sampling of all residential yards and indoor living areas and attics. If these areas exceed the human health action levels, yards and indoor areas will be cleaned and returned to pre-remediation conditions. Attics will be cleaned if users can demonstrate reasonable plans for use of the attic as living space. This would occur over a short time span. Other lead sources in homes would not be addressed under the non-programmatic approach.

Sites Not Granted "Conditional, Limited No Further Action" Status

Areas of the OU that have been reclaimed during previous TCRAs or N-TCRAs and that were determined NOT to meet ARARs and preliminary RAOs in the Response Action Summary Document were the following three sites:

- Colorado Smelter
- Lower Railroad Yard Site 1
- Lower Area One

The Colorado Smelter site and Lower Railroad Yard Site 1 were not granted a conditional, limited no further action status in the Response Action Summary Document. EPA Region 8 believes that the seasonal high water may be less than 10 feet below ground surface at these sites. Therefore, capped wastes at these locations may violate solid waste requirements. However, this is not clearly determined at this time. For this reason, additional data must be collected to determine the separation of the seasonal high water table from wastes at the Colorado Smelter and Lower Railroad Yard Site 1. If it is determined that the separation between the base of wastes and the seasonal high water table is less than 10 feet, wastes will be removed to a designated repository.

The Preferred Alternative for the Lower Area One site is described below in Groundwater Components.

Surface Water Components

The Preferred Alternative for surface water will entail three components:

- A BMP program to address contaminated storm water runoff.
- In-stream flow augmentation as appropriate to supplement BMPs.
- Removing contaminated sediments from the stream bed, banks, and adjacent floodplain of Blacktail and Silver Bow Creeks, from just above the confluence to the reconstructed floodplain in Lower Area One.

BMPs Approach for Storm Water

Storm water BMPs will be used to prevent storm water runoff from the OU from degrading surface water quality standards in Silver Bow Creek, Blacktail Creek, and Grove Gulch. A phased approach will be used and each phase will consist of the following five steps that will be repeated continuously:

- **Monitoring**. Surface water monitoring to provide data for analysis of compliance with remedial goals and performance standards and to evaluate the degree and location of continued contaminant loading to receiving surface waters. Baseline monitoring of storm water is currently underway as described in the Interim Surface Water Monitoring Program. This monitoring will continue through the completion of the ROD and any enforcement proceedings so as not to delay the implementation of storm water BMPs.
- **Compliance Analysis**. Analysis of data to evaluate compliance with remedial goals and performance standards.
- **Loading Analysis**. Assess contaminant loading to receiving surface waters. This helps identify potential loading sources and assists in determining where new BMPs may be needed.
- **BMP Selection**. Identification and prioritization (based on the previous steps and other indicators) of specific new BMPs (type and location).
- **BMP Implementation**. BMPs will be implemented to address compliance with regulatory goals.

Under the Preferred Alternative, BMPs include:

- Source controls on mine wastes or contaminated soil with arsenic and lead concentrations below human health action levels, but with elevated concentrations of other contaminants of concern. These could include waste removal or covers over source material along with consolidation grading.
- Temporary or permanent engineered sediment controls, such as: earthen dikes, straw bale dikes, silt fences, brush barriers, drainage swales, check dams, subsurface drains, pipe slope drains, rock outlet protection, sediment traps, retaining walls, drop structures or filter strips.
- Curb and gutters to channel run-on and runoff away from source areas.
- Detention/retention basins along storm water runoff channels to reduce (detention) or capture (retention) storm flows from defined precipitation events.
- Routing of storm flows away from receiving surface water (i.e., to the Berkeley Pit or to isolated areas or sedimentation basins).

- Removal of source materials to a repository.

If BMPs are not effective in achieving surface water quality standards in Silver Bow Creek, lime treatment of storm water runoff would be required. An evaluation of the amount of storm water that could practicably be treated would be performed. Storm flows up to a specific design criterion could then be collected and treated by lime treatment or redirected to the Berkeley Pit. If treatment is required, a conventional lime treatment plant will be constructed for this purpose. As described earlier, EPA has consulted with the State and other parties to identify appropriate "upfront" BMPs as an initial phase of this portion of the remedy.

Sites that have been identified for implementing initial BMPs under the Preferred Remedy are listed in *Unreclaimed Source Areas Not Exceeding Action Levels*, page 42.

In-Stream Flow Augmentation
The Preferred Alternative may include the addition of off-site source water if necessary to supplement surface water BMPs to improve the flow and quality characteristics of the water within Silver Bow Creek.

The Silver Lake water system and treated effluent from the future water treatment system for the Mine Flooding OU have been preliminarily identified as potential sources of clean water for in-stream flow augmentation. Administrative authorizations will be needed from the Montana Department of Natural Resources and Conservation for water use, per the Montana Water Use Act. Specific engineering evaluations will be performed to determine appropriate locations, flow volume modifications, and conveyance channel or culvert sizes and slopes.

Sediment Removal from Blacktail and Silver Bow Creek Channels
Elevated arsenic and metals occur in streambed sediments, the stream banks, and nearby floodplain from Blacktail Creek just above the confluence and through Silver Bow Creek to Lower Area One. The Preferred Alternative will excavate an estimated 670 cubic yards of contaminated sediment, stream banks, and floodplain wastes from the reach of Blacktail Creek just above the confluence with Metro Storm Drain down to the reconstructed floodplain and stream channel in Lower Area One.

Excavated sediments and other wastes will be hauled and placed in the Butte Mine Waste Repository. Contaminated sediments, stream banks, and nearby floodplain wastes will be removed to minimize impacts to surface water quality. The reconstructed stream banks and floodplain areas will meet remediation goals and performance standards.

Groundwater Components

The Preferred Alternative for groundwater will include five components:

- Two waste management units for saturated soils will be established in Lower Area One and Metro Storm Drain.

- Contaminated alluvial groundwater in the Metro Storm Drain will be captured with the existing subdrain and routed to Lower Area One.

- Contaminated alluvial groundwater in Lower Area One and lower Missoula Gulch base flow will be captured with the existing hydraulic control channel and open water areas and combined with contaminated bedrock groundwater from the Mine Flooding OU West Camp system and with

contaminated groundwater from the Metro Storm Drain and routed to a new conventional lime treatment facility near Lower Area One.

- Extensive groundwater monitoring for elevation and quality will be required, especially around Blacktail Creek and the plume.

- A controlled groundwater area will be established for the alluvial aquifer.

Metro Storm Drain
Mine waste materials include the Parrott Tailings, North Side Tailings, Diggings East Tailings and Lower Metro Storm Drain Tailings. These buried and partially saturated deposits consist of overburden, tailings, slag, waste rock, and other miscellaneous contaminated fill material with an estimated total volume of 2.5 million cubic yards.

Under the Preferred Alternative, these buried and partially saturated wastes will be managed in a waste management unit with appropriate groundwater monitoring and ICs. This will provide a continued understanding of the extent of groundwater contamination and long-term protection of human health and surface water resources.

Contaminated alluvial groundwater in the Metro Storm Drain will be captured with the existing subdrain and routed to Lower Area One for treatment and discharge to Silver Bow Creek. The subdrain, which was installed in 2003 and 2004, extends approximately 4,000 feet through lower Metro Storm Drain.

Groundwater discharge to the subdrain will reduce the amount of contaminated groundwater that enters Blacktail Creek and Silver Bow Creek. If it is later determined that the current subdrain is not effectively capturing contaminated groundwater, an additional groundwater capture system will be designed and constructed. This remedial component will remove the final significant source of contaminant loading to Silver Bow Creek during non-wet weather (base flow) conditions.

Lower Area One
Waste materials remain in Lower Area One even after the removal action. These wastes remain beneath immovable structures (Butte Metro Sewage Treatment Plant and historic slag walls) and beneath the vertical excavation limits established during the removal design.

Similar to the Metro Storm Drain component of the remedy described above, remaining wastes at Lower Area One will be managed in a waste management unit with appropriate groundwater monitoring and institutional controls.

Hydraulic controls constructed in the vicinity of the historic Colorado Tailings during the Lower Area One cleanup to capture, control, and extract contaminated alluvial groundwater and to prevent groundwater discharge to Silver Bow Creek are incorporated into the Preferred Alternative. These consist of a hydraulic control channel and a series of three open water areas that can be operated independently to alter groundwater elevations and manipulate flow. The system has operated since 1998 and has effectively prevented contaminated alluvial groundwater from flowing off site. The Preferred Alternative also incorporates walking trails and historical interpretive signage in Lower Area One into the final design plans.

If future groundwater monitoring data demonstrate that the current system of hydraulic controls is not fully effective, the remedy will be expanded to include extraction wells at the west end of Lower Area One to supplement the current groundwater capture system.

Under the Preferred Alternative, groundwater captured at Lower Area One will be combined with contaminated groundwater from the West Camp bedrock system of the Mine Flooding OU and contaminated alluvial groundwater from Metro Storm Drain and routed to a new conventional lime treatment facility where it will be treated to meet discharge standards and ARARs and subsequently discharged to Silver Bow Creek. Treatment capacity for the facility will be at least 1.1 million gallons per day (750 gallons per minute) to safely accommodate these flows.

The State believes that the final remedy for Butte should include the removal of the former Parrott Tailings area as described in Alternative 5b. EPA's detailed response to the State's concerns is contained in the administrative record.

Finally, the Preferred Alternative will address the previously reclaimed areas located within the 100-year floodplain (Colorado Smelter and Lower Railroad Yard Site Number 1) identified in the Response Action Summary Document as sites that may impact groundwater quality. Data will be collected to determine the depth to groundwater. If (at one or both sites) separation between the base of wastes and the seasonal high water table is determined to be less than 10 feet, wastes will be removed to a designated repository.

The estimated present value cost of the Preferred Alternative ranges from $39 to $56 million, depending on the BMP approach for addressing contaminated storm water runoff. If BMPs are not effective in achieving surface water quality standards in Silver Bow Creek, lime treatment of storm water runoff would be required at a present value cost of approximately $17 million (including operation and maintenance).

Institutional Controls

The Preferred Remedy includes the following ICs, at a minimum:

- Implementation of a groundwater control area in areas of groundwater contamination to prevent domestic use of this water and to prevent any well development which would exacerbate or spread existing contamination. These groundwater well prohibitions will require a developed program to monitor and enforce these prohibitions.

  Deed restrictions will be required for all areas where discrete waste units are left in place or created to notify the landowner of the unit and to ensure that these units are not disturbed inappropriately.

- County zoning and permit requirements must be implemented to ensure that discrete waste areas and other control measures, such as storm water controls, are not disturbed inappropriately, and that any waste taken from these areas is disposed appropriately. These controls and permit requirements are best implemented when accompanied with funds for appropriate redevelopment and re-use of these sites. EPA encourages the continued cooperation efforts among the PRPs to ensure that the extensive redevelopment efforts that have and are occurring at waste-in-place sites continues.

- Where private landowners require fencing or use posting for legitimate reasons relating to prevention of remedy disruption, the Preferred Alternative requires the installation of these fences or signs. As noted above, EPA encourages redevelopment and reuse where possible, but that is not always

compatible with a landowner's legitimate use plans at a given site.

Operation and Maintenance

These are several short-term operation and maintenance plans in existence for various actions within the sites. The Preferred Alternative requires the development of comprehensive monitoring and operation and maintenance plans for all aspects of the Preferred Alternative. As noted earlier, Butte Reclamation Evaluation System evaluations will be a major component of these plans.

Wetlands

The ARARs require a no net loss of wetlands at the OU. Wetland avoidance and/or mitigation will be required to achieve this standard, in accordance with existing protocols for wetland measurement and evaluation, if wetlands are impacted by past or future actions within the OU,

Rationale for Selection of Preferred alternative

The Preferred Alternative is judged to have equal or higher achievement of all the threshold and balancing criteria. It achieves substantial risk reduction and is feasible and implementable and cost-effective. Residual risks are effectively managed under the Preferred Alternative, as demonstrated by several years of experience at the site with groundwater and cap management.

The Preferred Alternative is fully compatible with redevelopment and reuse within Butte and Walkerville, and EPA and the State will continue to work cooperatively with the local county government and the PRPs to continue redevelopment efforts. Further rationale for EPA's selection of the Preferred Alternative for the OU is described below in the context of the different media of concern (solid media, surface water, and groundwater).

Solid Media

Non-Residential Areas

Contaminated solid media can generally be described as high volume/low toxicity waste. Outside of residential areas, there is an estimated total of approximately 12.4 million cubic yards of mining-related wastes within the OU.

Approximately 7.8 million cubic yards are located in upland areas (e.g., Metro Storm Drain, the Clark Tailings Repository, and outside Lower Area One) and include waste rock dumps and historic mill and smelter sites. Since 1988, most (6.9 million cubic yards over 422 acres) wastes in upland areas have been addressed through reclamation and/or removal in previous response actions. Approximately $45 million has been spent for these response actions, and with the exception of Lower Area One, Colorado Smelter, and Lower Rail Yard Site 1, these actions were determined to meet EPA cleanup objectives and to achieve site-specific standards.

During past response actions, upland areas were generally addressed by partial source removal, consolidation and grading, and in-place capping of remaining contamination. This method of addressing wastes in-place is consistent with the methods identified in the Preferred Alternative for addressing upland source areas.

The methodology was developed specifically for reclaiming source areas at the OU and has been refined to address upland source areas at the OU. Further, through implementation of the Butte Reclamation Evaluation System, this partial removal and capping methodology will provide a permanent and more cost-

effective remedy than complete removal or treatment of wastes in upland areas.

Residential Areas
The multi-pathway program is intended to provide reduction in lead, arsenic, and/or mercury human health exposure from a range of potential sources. The program was designed to comprehensively help prevent exposure of residents to lead, arsenic, and/or mercury by including responses that address numerous sources, some of which would not normally be remediated under Superfund (e.g., lead-based paint). The potential sources of lead, arsenic, and/or mercury exposure that will be addressed include soil, house dust, non-living space dust (only during remodeling), and interior paint (lead only for paint). This inclusive approach will prioritize residential cleanups to take into account the presence of sensitive populations and non-mining sources of lead, arsenic, and/or mercury.

To date, indoor and outdoor sources of lead contamination have been successfully removed from about 200 yards and homes through the ongoing Lead Intervention and Abatement program managed by Butte-Silver Bow County. Since the program began in the mid-1990s, $4.4 million has been spent on residential cleanups. EPA believes that this program, or a similar program, will be effective in preventing unacceptable residential exposures.

EPA believes the targeted and multi-pathway approach is protective and more cost-effective than an untargeted or complete removal scenario for all residences within the OU. EPA is hopeful the voluntary arrangements necessary for the continuation of this program can be implemented.

Surface Water

Components of the Preferred Alternative that address surface water include:

- Remove stream-bed and bank sediments and floodplain wastes from Blacktail Creek just above the confluence with the Metro Storm Drain down to the reconstructed channel of Lower Area One

- Implement the surface water BMPs program to reduce contaminant loading from storm water

Surface water components of the Preferred Alternative were included in all comprehensive remedial alternatives evaluated except for Alternative 1 (no-further action) and Alternative 6 (total removal). Remedial action for surface water is required if EPA's remedial goals of returning Silver Bow Creek to its beneficial uses and providing protection against recontamination of downstream remediation are to be achieved.

Contaminated stream-bed sediments have a direct impact on Silver Bow Creek water quality. Therefore, these sediments must be removed. Further, action is also required to minimize impacts from storm water runoff. Sources of copper, cadmium, and zinc occur throughout the OU.

Discrete sources of unreclaimed waste that do not exceed human health action levels are estimated at 800,000 cubic yards, but these source areas do not account for all the metal-laden sediment that is picked up and transported to Silver Bow Creek from the Butte Hill during storm events. Metals are disseminated across the surface of the Butte Hill and are readily carried by storm water runoff resulting in exceedences of acute water quality standards during most runoff events.

The BMP approach for storm water compliance is established nationally as the most effective means to mitigate environmental impacts from runoff at urban and industrial sites. Therefore, a site-specific program utilizing the BMPs approach has been designed and will be used to monitor, identify sources of contamination, and take appropriate corrective action. If BMPs are not effective in achieving surface water quality standards in Silver Bow Creek, lime treatment of storm water runoff would be required.

Groundwater

Components of the Preferred Alternative that address alluvial groundwater include:

- Two waste management units for saturated soils will be established in Lower Area One and Metro Storm Drain.
- Contaminated alluvial groundwater in the Metro Storm Drain will be captured with the existing subdrain and routed to Lower Area One.
- Contaminated alluvial groundwater in Lower Area One and lower Missoula Gulch base flow will be captured with the existing hydraulic control channel and open water areas and combined with contaminated bedrock groundwater from the Mine Flooding OU West Camp system and with contaminated groundwater from the Metro Storm Drain and routed to a new conventional lime treatment facility near Lower Area One.
- Extensive groundwater monitoring for elevation and quality will be required, especially around Blacktail Creek and the plume.
- A controlled groundwater area will be established for the alluvial aquifer.

Lower Area One
Capture and treatment of groundwater at Lower Area One is required to prevent off-site migration and eventual discharge to Silver Bow Creek downstream of the OU. Groundwater control components of the Lower Area One cleanup were constructed in 1998 and now essentially all alluvial groundwater that passes beneath Lower Area One is captured.

Metro Storm Drain
Capturing groundwater and diverting it for treatment provides for long-term protection of Silver Bow Creek but does not achieve ARARs in the alluvial aquifer in the Metro Storm Drain Area. However, complete removal of the wastes in the Metro Storm Drain as specified in Alternative 6 will cost an estimated $130 million, but will not effectively clean up the aquifer within a reasonable time-frame to the point that it achieves standards.

Analyses indicate that, even by removing wastes, low aquifer permeability and wide distribution of residual contamination will prohibit the aquifer from becoming clean for hundreds of years.

Municipal water is currently provided from a source outside Butte and is distributed throughout the city. Further, Butte-Silver Bow County enforces an ordinance that discourages residential well use. The ordinance requires hook-up to municipal water system if property is within 300 feet of the existing municipal water distribution system.

Finally, groundwater treatment at Lower Area One is already a required component of EPA's Preferred Alternative. Thus, the cost for the Metro Storm Drain portion of the Preferred Alternative is for capturing and routing Metro Storm Drain groundwater to the treatment plant in Lower Area One and

for increasing the treatment capacity of the groundwater treatment facility from 500 to 725 gallons per minute. Shallow groundwater that formerly discharged to the Metro Storm Drain channel and flowed into Silver Bow Creek is now captured in a subdrain (French drain) constructed in 2003 and 2004.

Summary of the Preferred Alternative

Based on information currently available, EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of trade-offs among the other alternatives with respect to the balancing and modifying criteria. EPA expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA Section 121 (b) to:

1. be protective of human health and the environment;
2. comply with ARARs except where an ARAR waiver for groundwater standards is proposed;
3. be cost-effective; and
4. utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable.

EPA also believes the Proposed Plan explains why there is limited treatment required at this site.

Community Participation

Public Comment Period

The public comment period for the Proposed Plan will last for 60 days following the issuance of the Proposed Plan. The specific dates are: December 20, 2004 to February 18, 2005. Public comments must be submitted in writing to EPA by February 18, 2005.

Individuals may also contact the Citizens Technical Environmental Committee (CTEC) to add their comments and concerns to those submitted by those groups (see contacts below).

Public Meeting

A public meeting has been scheduled for January 25, 2005. It will be held in the Carpenter's Union Hall, 156 W. Granite Street. The meeting will be from 6:30 to 8:30 pm. EPA will present the Proposed Plan, answer clarifying questions, and will record formal public comment which will be responded to when EPA issues the ROD.

Locations of the Administrative Record File

The Administrative Record is the official record of all public documents for the OU. It is open to the public and is located in Helena at:

EPA Montana Operations Office
10 West 15th Street. St. 3200
Helena, Montana 59626
Monday – Friday, 8:00 am - 4:30 pm

There are also two local document repositories in Butte that have copies of all relevant public documents, such as the RI, the FS, and the Proposed Plan:

Butte EPA Office
155 W. Granite, Butte, Montana 59701
406-782-3264
Monday – Friday, 8:30-5:00 pm

Montana Tech Library
1300 W. Park, Butte, Montana 59701
406-496-4668
Monday – Friday. 8:00 am - 4:30 pm

Contacts

EPA encourages interested individuals to contact any of the EPA or State representatives listed below for additional information on the Butte Priority Soils OU or to provide individual comments on the Proposed Plan.

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Montana DEQ (State)
1100 North Last Chance Gulch
Helena, Montana 59620
Project Officer
Joe Griffin - 406-841-5042 or
406-560-6060
jgriffin@state.mt.us

Citizens' Group
Citizen's Technical Environmental Committee (CTEC)
CTEC President
Jill Larson - 406-723-6247
(between 10 and 2)

Silver Bow Creek floodplain before waste removal (1969) and after (2002)

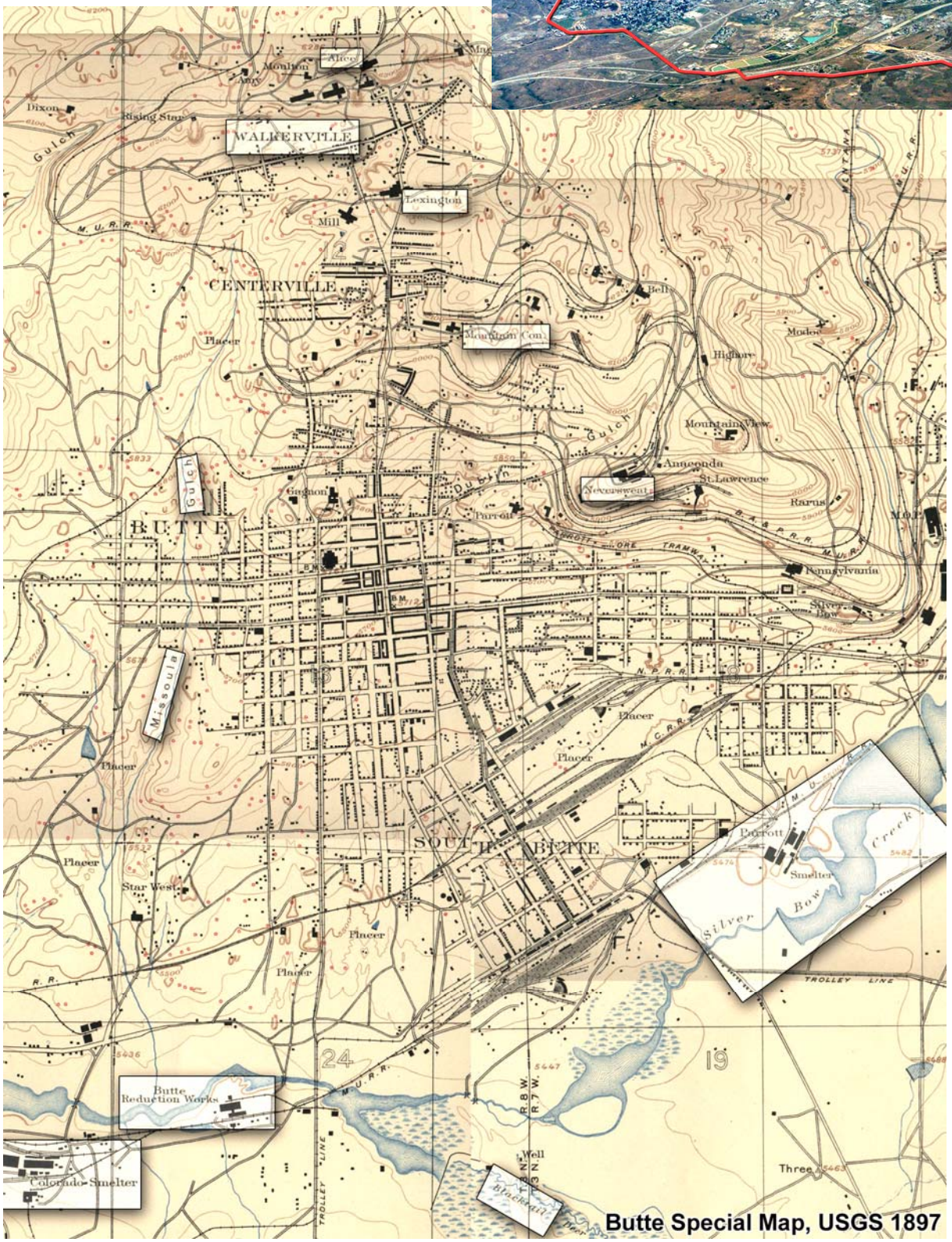
Lexington Head Frame and Mine Yard before and after Walkerville TCRA

West Missoula Gulch before and after removal

Residential yard before and after removal

Examples of Superfund Removal Actions taken at the Butte Priority Soils OU

Relationship of the Butte Priority Soils OU to the Butte/Walkerville Urban Setting



Historic map of Butte showing various mine features

U.S. EPA Region 8, Helena, Montana